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COMPUTATION OF THE PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

by

A. R. DiDONATO

R. K. HAGEMAN

Warfare Analysis Department

APRIL 1977

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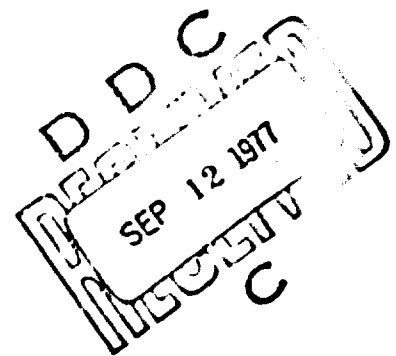
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A. R. DiDonato

R. K. Hageman



11-11-73

FOREWORD

This technical report was written in the Applied Mathematics Section, Science and Mathematics Research Group, Warfare Analysis Department.

The authors are indebted to Dr. Marlin Thomas and members of his Statistical Analysis Branch for helping to choose the input values for the table of percentage points given in Appendix A.

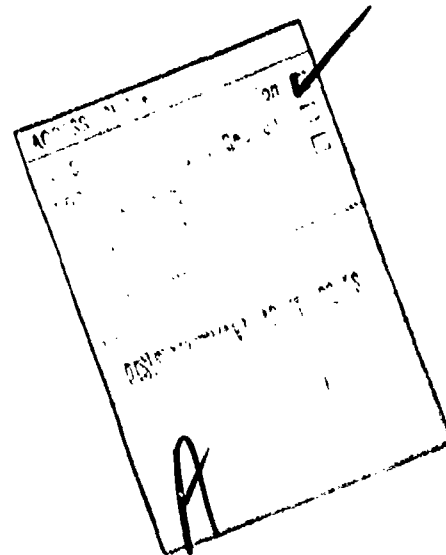
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Released by:

Ralph A. Niemann

RALPH A. NIEMANN

Head, Warfare Analysis Department



ABSTRACT

A Fortran IV program is developed for computing the percentage points of the Chi-square distribution. The Newton-Raphson procedure is used with good initial approximations. The maximum number of iterations is four and in most cases only one or two are needed. An extensive table is given of the percentage points χ^2 in terms of ν , a positive number, and $Q(\nu|\chi^2)$, the probability integral of the Chi-square distribution.

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1. INTRODUCTION

The primary objective of this paper is to describe the effective use of the Newton-Raphson procedure (N-R) for finding the percentage points of the Chi-square distribution. For a given value of $Q(\nu|\chi^2)$ and one of $\nu > 0$, the value of χ^2 is found, where

$$Q(\nu|\chi^2) = [2^{\nu/2}\Gamma(\nu/2)]^{-1} \int_{\chi^2}^{\infty} e^{-t/2} t^{(\nu/2)-1} dt, \quad \nu > 0 \quad (1)$$

$$0 \leq Q(\nu|\chi^2) \leq 1, \quad P(\nu|\chi^2) \equiv 1 - Q(\nu|\chi^2), \quad Q(\nu|0) = 1. \quad (2)$$

Here $\Gamma(\cdot)$ denotes the complete gamma function.

The final results of this study are a Fortran IV program which is listed in Appendix C, and an extensive table of percentage points with six correct significant digits. The program was used on the CDC 6700 to construct the table which contains 72,000 entries. The entire calculation took only 7.5 minutes with an average of 2(N-R) iterations per entry. The table is given in Appendix A. A very condensed version is also given in Appendix B primarily to exhibit a corrected copy of the table in [1, pp. 984-985]. The program was also employed to check a table of 5290 entries by Harter, [4, pp. 137-161]. No errors larger than one unit in the last place were found. They are listed in Section 5.

Because the notation is more convenient, we shall work with the incomplete gamma function ratios, $P(a, x)$ and $Q(a, x)$, [2] instead of the corresponding $P(\nu|\chi^2)$ and $Q(\nu|\chi^2)$, where

$$P(a, x) = \frac{1}{\Gamma(a)} \int_0^x e^{-t} t^{a-1} dt = P(\nu/2|\chi^2/2) \quad (3)$$

$$Q(a, x) = \frac{1}{\Gamma(a)} \int_x^{\infty} e^{-t} t^{a-1} dt = Q(\nu/2|\chi^2/2), \quad (4)$$

$$0 \leq \nu = 2a, \quad 0 \leq \chi^2 = 2x. \quad (5)$$

The relationships between (1), (2) and (3), (4) are well-known and easy to show using (5).

For easy reference, we note that the (N-R) refers to an iterative procedure for computing a root r of a function $f(t) \in C^1$. The $(n+1)$ st iterate is given by

$$t_{n+1} = t_n - f(t_n)/f'(t_n), \quad n = 0, 1, \dots \quad (6)$$

If convergence occurs so that

$$\lim_{n \rightarrow \infty} t_n = y, \quad f(y) = 0, \quad (7)$$

and moreover if $f'(y) \neq 0$, then

$$\lim_{n \rightarrow \infty} [|t_{n+1} - y| = \frac{1}{2} |f''(y)/f'(y)| |t_n - y|^2], \quad [6, \text{pp. 329-330}]. \quad (8)$$

A glance at (8) shows that for t_{n+1} sufficiently close to y the error in t_{n+1} is approximately proportional to the square of the error in t_n . This is the attractive feature of the (N - R), and it applies in our case since $f' = dP/dx$, or dQ/dx , is always positive, or negative, respectively for $x > 0$, i.e., never zero.

In order to successfully use the (N - R) to find x from $P(a, x)$ or $Q(a, x)$, the following questions required affirmative answers:

- 1) Can $P(a, x)$ and $Q(a, x)$ be computed efficiently to high relative accuracy?
- 2) Can a "good" initial approximation to x , denoted hereafter by x_0 , always be found?
- 3) Will the (N - R) always converge for such x_0 ?

Treating the third question first, it is easy to show from (3) that for fixed $a \leq 1$, $P(a, x)$ is concave for all $x \geq 0$, and that for $a > 1$, $P(a, x)$ has an inflection point at $x = a - 1$ with P convex for $0 \leq x < a - 1$ and concave for $x > a - 1$. Similar properties hold for $Q(a, x)$. Typical curves are shown in Figure 1.

It can be shown analytically or from a geometric interpretation of the (N - R) that convergence will occur when $a \leq 1$ provided $x_0 \leq x$, and also when $a > 1$ if $x_0 = a - 1$. Thus global convergence can always be achieved without much difficulty.

Nevertheless, experimentation shows that if x_0 is chosen simply to assure convergence in the ways just described, the rate of convergence in most cases will be slow. Therefore for better efficiency, efforts were made to determine an x_0 "close" to x even though the sufficient conditions noted above might not be

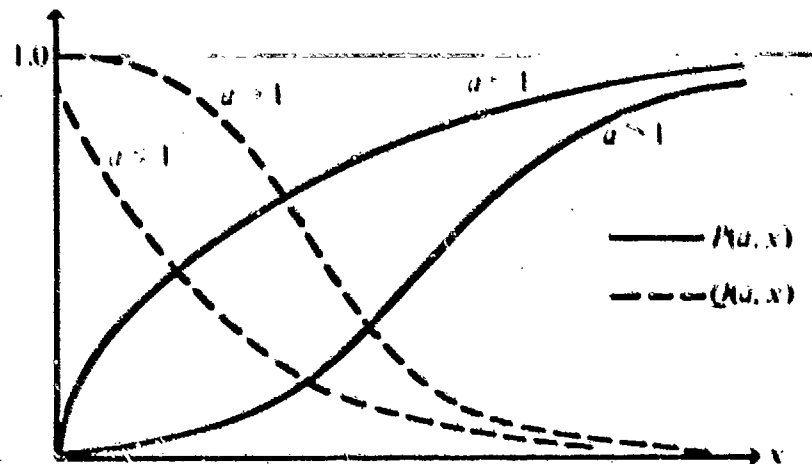


Figure 1. Typical curves of $P(a, x)$ and $Q(a, x)$ for fixed a .

satisfied. Convergence then would be established from computer results. This approach lead to a set of initial approximations depending on P , Q , and a , such that for $\epsilon < P < 1 - \epsilon$ ($\epsilon = 5 \times 10^{-13}$), no more than four iterations of the $(N - R)$ were needed to obtain x correctly to about 8 significant digits in every case tried including the 72,000 entries of the table in Appendix A.

For the $(N - R)$ to work so well not only are "good" starting values x_0 required, but also P , Q and their first derivatives must be available to high precision. This presented no problem because of a previous study of ours, [2], from which a computer program was developed giving P and Q to 12 significant digits for all $a > 0$, $x > 0$. The high precision requirements are necessary, of course, when x is desired to many digits. In addition, they are also needed when P is very close to zero or one otherwise the last term on the right hand side of (6) could carry no reliable digits with disastrous effects on the iterations.

Clearly then, the three questions posed above can be answered in the affirmative, and consequently a computer program based on the $(N - R)$ to find the percentage points of the chi-square distribution can be constructed.

In the next section we obtain the initial approximations for x . In Section 3, the criteria for terminating the $(N - R)$ are specified. In Section 4, the computer program is described, and a flow chart is given.

2. INITIAL APPROXIMATIONS

Our objective in this section is to give approximations for x which result in rapid convergence of the $(N - R)$ to a final estimate for x , say x^* . By rapid convergence we mean that no more than 4 iterations are necessary for about 8 correct significant digits in x^* .

We remark here that some of the analysis below is heuristic with the emphasis on plausibility, and attaining efficiency in the use of the $(N - R)$, at expense of rigor. The usefulness of the initial approximations is evaluated primarily by computer experimentation. No effort is made to obtain associated error bounds on $|x_0 - x|$, where x_0 denotes the initial approximation.

The input values of $P(a, x)$ and $Q(a, x)$ are denoted by P and Q , respectively. For the remainder of this section, as well as Sections 3 and 4, the flow chart on page 11 will be helpful.

Two sets of initial approximations for x are used depending on whether $a \leq 1$ or $a > 1$. (If $a = 1$, then $x = -\ln(Q)$.)

Considering $a \leq 1$ first, let

$$B = Q(a). \tag{9}$$

Then for $B \geq .45$, we have $x \leq 1$. For, if it is assumed that $x > 1$, then with $a < 1$

$$.45 \leq B = \int_1^{\infty} e^{-t} t^{a-1} dt < e^{-x}.$$

This inequality implies $x < .7985$ contrary to the assumption $x > 1$. Thus with $x < 1$ an approximation for x_0 , say u , can be obtained from

$$P(a, x) = \frac{x^a}{\Gamma(a+1)} \left[1 - \frac{ax}{(a+1)!} + \frac{ax^2}{(a+2)!} - \dots \right], \quad [1, p. 262] \quad (10)$$

by dropping all terms but the first, i.e.,

$$u = [P\Gamma(a+1)]^{1/a}. \quad (11)$$

This result is improved by using the first two terms of (10) with (11). In this case

$$u \cong x_0 \left(1 - \frac{au}{a+1} \right)^{1/a} \cong x_0 \left(1 - \frac{u}{a+1} \right)$$

or

$$\boxed{x_0 \cong u/[1 - u/(a+1)]}, \quad B \geq .45, \quad a < 1. \quad (12)$$

We see that $1 - u/(a+1) > 0$. Indeed, from (10), $u < x$ for $x < 1$. Hence $u/(a+1) < x/a+1 < x$ and $1 - u/(a+1) > 1 - x > 0$.

If $B < .45$ (with $a < 1$), then an approximation for x_0 is found from the asymptotic series

$$Q(a, x) \cong [R(a, x)/x] \left[1 + \frac{a-1}{x} + \frac{(a-1)(a-2)}{x^2} + \dots \right], \quad (x \rightarrow \infty), \quad [1, p. 263], \quad (13)$$

where

$$R(a, x) = e^{-x} x^a / \Gamma(a). \quad (14)$$

We have by carrying only the first term on the right hand side of (13)

$$e^{-x} x^{a-1} \cong Q\Gamma(a) = B < .45, \quad (15)$$

and taking logarithms

$$-x + (a-1)\ln x \cong \ln B. \quad (16)$$

For $a < 1$, $x > 1$, the first term on the left dominates the second, giving as a first approximation to x_0

$$y = -\ln B. \quad (17)$$

This estimate for x_0 is then improved by using it in (16) to get

$$v = y + (a-1)\ln y. \quad (18)$$

We improve the result still further by using a rational approximation for Q , [5].

$$Q \approx [K(a, x)/x] \left(\frac{x+1}{x+2-a} \right), \quad (19)$$

and obtain

$$x \approx -\ln B + (a-1) \ln x - \ln [(x+2-a)/(x+1)] \quad (20)$$

Now using v , as given by (18), for x on the right hand side of (20), we have

$$x_0 \approx v - (1-a) \ln v - \ln [(v+2-a)/(v+1)] \quad B < .45, \quad 0 < a < 1. \quad (21)$$

We digress here briefly to show that the arguments of the logarithms in (21) are always positive for admissible values of a, x . Indeed, since $B < .45$,

$$v = -\ln B > -\ln .45 = v_m \approx .7985, \quad (22)$$

so that for $v_m \leq v \leq 1$, we have from (18), with $a < 1$,

$$x \geq v \geq v_m \approx .7985.$$

For $v > 1$, we have from (18) that $dv/dv = 1 + (a-1)/v > 1 - 1/v > 0$, also $v = 1$ at $v = 1$. Therefore $v > .7985$ for all $B < .45, a < 1$. Also $v + 2 - a > .7985 + 2 - a > 1.7985$.

It is possible when x is in the neighborhood of the computer determined value 0.62 that (12) is better than (21) as a choice for x_0 , even though $B < .45$, or that (21) is better than (12) when $B > .45$. Denoting x_0 from (12) by x_{01} and x_0 from (21) by x_{02} , it was concluded from computer experimentation that when $B > .45$ and $x_{01} > .57$, or $B < .45$ and $x_{02} < .67$ that usually the best choice for these situations was to take x_0 as the larger of x_{01} and x_{02} .

For $a > 1$, we consider the Cornish-Fisher six term approximation for v and denote it by \tilde{v}_0 . [3] A quantity x is determined first, where for a given Q

$$Q = \frac{1}{\sqrt{2\pi}} \int_0^x e^{-t^2/2} dt = q(x). \quad (23)$$

The value of x for a given value of $Q \in (0, 1/2]$ is obtained from the rational approximation

$$x \approx \frac{a_0 + a_1 Q + a_2 Q^2 + a_3 Q^3}{1 + b_1 Q + b_2 Q^2 + b_3 Q^3 + b_4 Q^4} \quad Q = (-2 \ln Q)^{1/2}. \quad (24)$$

where the coefficients are determined by the Chebyshev minimax error criterion. They are given by

$$\begin{aligned} a_0 &= 3.3112 \ 59221 \ 08741 & b_1 &= 6 \ 6105 \ 37656 \ 25462 \\ a_1 &= 11 \ 661 \ 67202 \ 88968 & b_2 &= 6 \ 4069 \ 15977 \ 68039 \\ a_2 &= 4 \ 2834 \ 21589 \ 67104 & b_3 &= 1 \ 2746 \ 44897 \ 52224 \\ a_3 &= 21362 \ 34937 \ 15853 & b_4 &= 36117 \ 08101 \ 88470411 \end{aligned} \quad (25)$$

Computer results indicate that the maximum relative error is no larger than 10^{-5} for $10^{-30} < Q < 5$. A similar expression is given in [1, p. 933] with that rational function containing one less term in both numerator and denominator. For values of $Q > 1.2$ ($P > 1.2$), x was found for $1 - Q$ and then replaced by $(x - 1)$. Once x is computed, the Cornish-Fisher expansion [3] yields an approximation x_0 to x , namely

$$\begin{aligned} x_0 &= a + \sqrt{a} \left[s + (s^2 - 1) \left(3 + s(s^2 - 7) \right) / 30 \right] \sqrt{a} \\ &\quad - \left[(6s^4 + 14s^2 - 32) / 1620 a \right] + s(9s^4 + 25s^2 - 433) / 38880 a^{3/2} \end{aligned} \quad (26)$$

We remark here that an improved version of the Wilson-Hilferty approximation for x , [7] in terms of x_0 also, was not as good as (26). For completeness, we give that approximation

$$\begin{aligned} x_0 &\approx a \left[1 - 1/9a + (x - h) \sqrt{3/a} \right]^3 \\ h &= [3(s^2 - 3) - 8(s^2 - 1) \sqrt{3/a}] / 108a \end{aligned} \quad (27)$$

The quantity x_0 given by (26) improves as an estimate for x as a increases. Experimentation shows, when $P > 1.2$, that if $a > 19$, or if $x_0 > 0.116z + 1$, that x_0 is acceptable as x_0 . However, if $a < 19$ and $x_0 < 0.116z + 1$, with $P > 1.2$, then another choice for x_0 is considered. In particular, from (10)

$$a = [P(z + 1)]^{1/a} = x \left(1 + \frac{z}{x + 1} \right) \quad (28)$$

or, replacing x with x_0

$$\frac{1}{a + 1} x_0^2 - x_0 + z = 0 \quad (29)$$

The quadratic has solution

$$x_0 = \frac{z + 1}{2} \left[1 \pm \sqrt{1 - 4z(z + 1)} \right] \quad (30)$$

Indicating the solution with the minus sign by x_0^- or x_{0-} , we have

$$x_0^- = \frac{z + 1}{2} \left[1 - \sqrt{1 - 4z(z + 1)} \right] \quad (31)$$

The root in (31) with the plus sign, $x(+)$ should not be used, because it does not yield a good approximation to x when $x/(a+1)$ is small. Indeed, the approximation for u given in (29) is only good if $x/a+1$ is small. Therefore, we have from (29) $\tilde{x} \cong u$. In addition, we also conclude from (30) that in fact $u < \tilde{x}$, so that

$$u/(a+1) < \tilde{x}/(a+1) \ll 1. \quad (33)$$

Then expanding the radical of (31) gives the desired result, $\tilde{x} \cong u$ from $x(-)$ but not from $x(+)$ which precludes the use of $x(+)$.

The choice between \tilde{x}_0 and \bar{x}_0 ($x(-)$) was made by experimentation. The conclusions were: If $P \leq 1/2$, $a \leq 19$, $\tilde{x}_0 \leq 0.11(a+1)$ and $a > 4$, or instead of $a > 4$, $a \leq 4$ and $P \leq n_j$, where j equals that $i = 1, 2, 3, 4$ for which $|a - i|$ is a minimum and $n_1 = .15$, $n_2 = .05$, $n_3 = .01$, $n_4 = .001$, then \tilde{x}_0 from (32) is taken as x_0 . On the other hand \bar{x}_0 of (26) is taken as x_0 under the conditions specified earlier, or when $P \leq 1/2$, $a \leq 19$, $\tilde{x}_0 \leq 0.11(a+1)$, $a \leq 4$ and $\bar{P} > n_j$.

When $\bar{P} > 1/2$ and $a \geq 11$, then again \tilde{x}_0 is a satisfactory choice for x_0 . If however $\bar{P} > 1/2$ and $1 < a < 11$, then experimentation shows a better estimate than \tilde{x}_0 is obtained from

$$x_0 = y - (1-a) \ln \tilde{x}_0 - \ln [(\tilde{x}_0 + 2 - a)/(\tilde{x}_0 + 1)] \quad (34)$$

provided that in addition we also have

$$\tilde{x}_0 > 4a. \quad (35)$$

Equation (34) is obtained in much the same way as (21) so its derivation is not given.

3. CRITERIA FOR TERMINATING $(N-R)$

In this section we discuss the ways in which the $(N-R)$ is terminated. Since we are interested in getting x correct to about 8 significant digits we required

$$|x_N - x_{N-1}| < \lambda x_N, \quad \lambda = 5 \times 10^{-5}, \quad (36)$$

where x_N denotes the N^{th} iterate of $(N-R)$. If the inequality holds, then x_N and x_{N-1} agree to at least 4 significant digits. However, this means x_N has close to 8, since by (8)

$$|x_N - x|/x \cong K |x_{N-1} - x|^2/x^2, \quad K < \frac{1}{2} |a - 1 - x|. \quad (37)$$

which implies the relative error in x_N is proportional to the square of the relative error in x_{N-1} . The proportionality factor K can be large when a and P are large, for example, $K \cong 3525$ when $a \cong 10^6$, $Q \cong 10^{-12}$, but it is also true for large a that x_0 is very close to x . In fact, for the example above x_0 , from (26), already gives x to 11 significant digits. Computer results support our conclusion drawn from (37).

Although the primary goal is to insure the accuracy of x^* to about 8 significant digits (it is recalled x^* is the final iterate from $(N - R)$). See page 3. A secondary objective is to satisfy (40) or (41) below. In this connection, we required once (36) was satisfied, that

$$|x_N - x_{N-1}|^2 |a - x_N - 1| (a + 1 - x_N) \leq 2 \left(\frac{a+1}{a} \right) \lambda x_N^2 \quad \text{if } a > x_N - 1 \quad (38)$$

or

$$|x_N - x_{N-1}|^2 (x_N + 1 - a)(x_N + 2 - a) \leq 2 \lambda x_N (x_N + 1), \quad \text{if } a \leq x_N - 1. \quad (39)$$

If (36) is satisfied but the appropriate inequality, (38) or (39), is not, then one more iteration of $(N - R)$ is carried out before stopping the procedure. We note in this case $x^* = x_{N+1}$. At $\lambda = 5 \times 10^{-5}$ no cases were found where the designated inequality, (38) or (39), was not satisfied, however for smaller values of λ , for example 6×10^{-7} some cases did occur and one more iteration was made.

Inequalities (38) and (39) are employed to test whether

$$|P(a, x_N) - P| \leq \lambda P, \quad \text{if } P \leq 1/2, \quad (40)$$

or

$$|Q(a, x_N) - Q| \leq \lambda Q, \quad \text{if } Q < 1/2, \text{ respectively.} \quad (41)$$

Ideally, we would like that (38) always implies (40) and (39) always implies (41). This will not always be the case because of the approximations that are used to get (38) and (39). In general however computer results indicate that (38) and (39) work quite well in establishing (40) and (41).

We derived (38) in the following way. Let P_n denote $P(a, x_n)$. Taking two terms of the Taylor series expansion of P about x_N , we have

$$(P - P_N) P_N \approx (x - x_N) P'_N P_N. \quad (42)$$

Using the expressions

$$P(a, x) = [R(a, x)/a] A(a, x), \quad P'(a, x) = R(a, x)/x, \quad (43)$$

where

$$A(a, x) = 1 + \sum_{k=1}^{N-1} \frac{x^k}{(a+1)(a+k)}, \quad [1, p. 262]$$

$$P'_N P_N = [R(a, x_N)/x_N] P [R(a, x_N)/a] A(a, x_N) \quad (44)$$

$$\approx \frac{a}{x_N} \left[1 + \frac{1}{x_N(a+1)} \right] \approx \frac{a}{x_N} \left(1 + \frac{x_N}{a+1} \right) = \frac{a}{a+1} (a+1-x_N) \lambda x_N$$

Using this result in (42)

$$(P - P_N)/P_N \cong (P'_N/P_N)(x - x_N) \cong \frac{a}{a+1} (a+1 - x_N)(x - x_N)/x_N, \quad (x_N < a+1). \quad (45)$$

Now using an approximation to (37) in (45), namely

$$\begin{aligned} |x - x_N|/x_N &\cong K|x - x_{N-1}|^2/x_N \\ &\cong \frac{1}{2} |a - 1 - x_N||x_N - x_{N-1}|^2/x_N^2. \end{aligned} \quad (46)$$

we have

$$|P - P_N|/P_N \cong \frac{1}{2} \frac{a}{a+1} (a+1 - x_N)|a - 1 - x_N||x_N - x_{N-1}|^2/x_N^2, \quad x_N < a+1. \quad (47)$$

Constraining the right hand side to be no greater than λ yields (38).

Inequality (39) is obtained in much the same way. Again

$$(\bar{Q} - Q_N)/Q_N \cong (Q'_N/Q_N)(x - x_N). \quad (48)$$

Approximating Q_N by (19), and differentiating (4), we obtain

$$|Q'_N/Q_N| \cong (x_N + 2 - a)/(x_N + 1), \quad x_N > a - 2, \quad (49)$$

which when used in (48) gives

$$|\bar{Q} - Q_N|/Q_N \cong (x_N + 2 - a)/(x_N + 1)|x - x_N|. \quad (50)$$

Thus approximating (37) as above by (46) and using the result in (50) gives

$$\frac{|\bar{Q} - Q_N|}{Q_N} \cong \frac{1}{2} (x_N + 2 - a)|x_N + 1 - a||x_N - x_{N-1}|^2/x_N(x_N + 1), \quad x_N > a - 2. \quad (51)$$

Constraining the right hand side to be no greater than λ gives (39). Since the approximation for Q , given by (19), improves with increasing x , we used (39) for $x_N \geq a+1$ rather than $x_N > a-2$.

4. COMPUTER PROGRAM

The flow chart at the end of this section on page 11 shows in some detail the basic organization and flow of the program. The boxes marked (A) and (B) refer to particular forms of the (N - R) which are used. Thus (A) refers to the algorithm

$$x_{n+1} = x_n [1 - (P(a, x_n) - PVR(a, x_n))], \quad n = 0, 1, \dots \quad (52)$$

and (B) refers to

$$x_{n+1} = x_n [1 + (Q(a, x_n) - Q)/R(a, x_n)], \quad n = 0, 1, \dots, \quad (53)$$

where it is recalled P, Q, a are given and $R(a, x)$ is defined by (14). For $\bar{P} \leq 1/2$, (52) is used and when $\bar{P} > 1/2$ (53) applies. By a single call to the incomplete gamma function ratio routine (PAX 6), [2], the quantities $P(a, x_n)$, $Q(a, x_n)$ and $R(a, x_n)$ are computed to an accuracy of one unit in the twelfth significant digit. (There is an option of obtaining 6 or 3 significant digits, instead of 12, if desired.) If $a < 100$, $R(a, x_n)$ is always available from (PAX 6). In order to obtain $R(a, x_n)$ when $a \geq 100$ and $3a \leq 4x \leq 5a$ however, an appropriate modification of the original version of PAX 6) was made.

The conditions under which (N - R) is terminated were discussed in the previous section. Essentially, the iterations continue until

$$|x_N - x_{N-1}| \leq \lambda x_N. \quad (54)$$

Then for $x_N < a + 1$, (38) is checked, or if $x_N \geq a + 1$ then (39) is checked. Denoting the final output value for x by x^* , if the applicable inequality, (38) or (39), is satisfied then $x^* = x_N$, if it is not satisfied then one more (N - R) iteration is carried out and $x^* = x_{N+1}$.

The program is presently set with $\lambda = 5 \times 10^{-5}$. By arguments given previously this insures close to 8 correct significant digits for the output value x^* . In the case of the table in Appendix A, λ was set to 5×10^{-6} .

A reflection of the very good initial approximations (x_0) for x is the fact that no case was found where more than 4 iterations was required, including the 72,000 entries of the table in Appendix A. The methods by which x_0 is obtained were discussed in Section 2.

An estimate of the average computing time per case for the CDC 6700, with $\lambda = 5 \times 10^{-5}$, is about 4 milliseconds.

A feature of the program permits the user to specify a starting value, \bar{x}_0 , of his own. Thus if the user desires more significant figures in x^* , he need only make an additional call to the program specifying \bar{x}_0 as the last value of x^* obtained. Or, it maybe that the user can, in special circumstances, actually supply better starting values than those given by the program.

As a result of this option for the user, the possibility of a poor choice for x_0 arises. For example $\bar{x}_0 < 0$ or \bar{x}_0 such that $x_n < 0$, or \bar{x}_0 such that many iterations of (N - R) are needed. With this in mind, an additional output location, call it Y , is allotted to inform the user of errors in input or poor choices for x_0 . In particular

If $n \in Y$, n , a positive integer, indicates the number of iterations by (N - R).

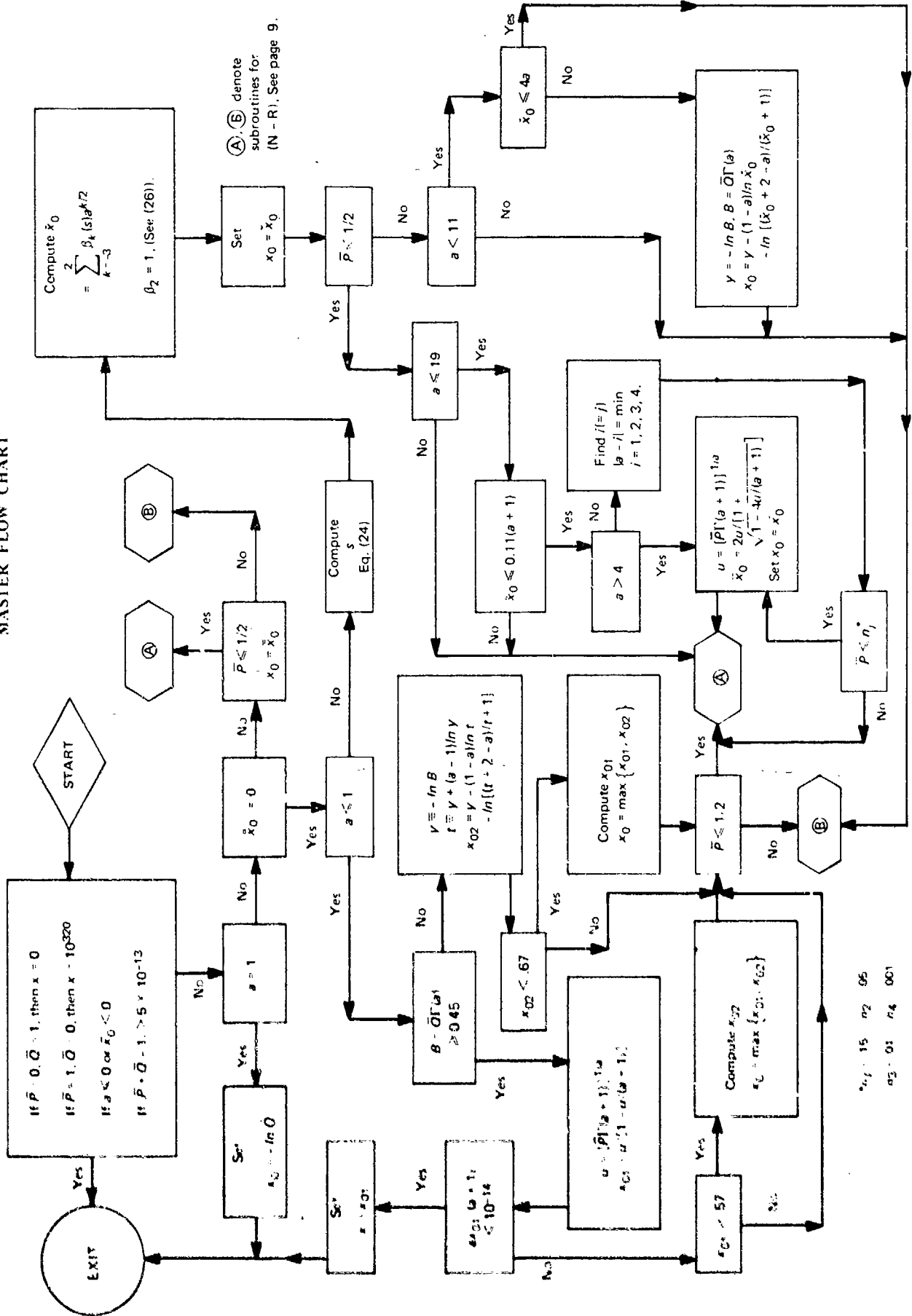
If $n = 0$, then either $a > 1$ or $a < 1$, $B > .45$, (see (9)), and $ax_0/(a + 1) < 10^{-14}$, or $P = 1$, $Q = 0$, or $P = 0$, $Q = 1$. In every case an acceptable value for x is given.

If $-2 \in Y$, $a \leq 0$ has been specified. No x^* is found.

If $-4 \in Y$, $|P + Q - 1| > 5 \times 10^{-13}$, i.e., P and $Q = 1 - P$ are not compatible. No x^* is found.

If $-5 \in Y$, x_0 specified by the user is negative. No x^* is found.

MASTER FLOW CHART



(A), (B) denote subroutines for (N - R). See page 9.

15 02 05
03 01 04 001

If $-6 \in Y$, 20 iterations of $(N - R)$ have occurred. A poor choice of \bar{x}_0 by the user is indicated. x^* is given but it may not be very accurate.

If $-7 \in Y$, x_n from $(N - R)$, using (52) or (53) is negative no value for x^* is given.

It is the user's responsibility to check location Y .

The program has been validated for values of λ ranging from 10^{-6} to 10^6 with $P \in [\epsilon, 1 - \epsilon]$, ($\epsilon = 5 \times 10^{-13}$). The program experienced no difficulty. Also Harter's table of percentage points [4] were used as a check. A list of the errors found in his table is given in the next section.

Finally, we remark that it is possible to speed up the program by requiring fewer correct significant digits in x^* . For example for $\lambda = 5 \times 10^{-2}$, the average computing time is reduced from 4 to 2 milliseconds with x^* good to 3 or 4 significant digits. A further decrease in computing time for $\lambda = 5 \times 10^{-2}$ can be achieved by requiring less accuracy in the computation of P, Q , say 6 significant digits instead of 12. This is accomplished by setting a parameter in the PAX 6 subroutine, (see [2]). Under these circumstances the average computing time per case would be about 1.5 milliseconds.

5. ERRORS IN HARTER'S TABLE

Harter's table is a tabulation with 5290 entries of χ^2 in terms of ν and $P(\nu|\chi^2)$. It is contained in [4, pp. 137-161]. The input values of ν and $P(\nu|\chi^2)$ that he used also make up part of the input for the much larger table in Appendix A of this report.

A careful check of Harter's results shows that 139 of his values for χ^2 are in error by one unit in the 6th significant digit which is also the last recorded digit. Certainly such errors detract very little from his table. We list the necessary corrections below. The page number in [4] is given first as a heading. The first, fourth, and seventh columns refer to values of ν , the second, fifth, and eighth columns refer to values of $P(\nu, \chi^2)$, and the third, sixth and ninth columns to the associated error. If a plus one (+1) occurs in the error column (denoted by E) this means a one should be added in the last place of Harter's tabulated result for χ^2 ; in case a minus one (-1) occurs a one should be subtracted. For example, the listing below indicates an error on page 161, $\nu = 322$, $P(\nu|\chi^2) = .9500$. It is shown in the error column as a (-1). Therefore Harter's result of $\chi^2 = 364.848$ should be changed to $\chi^2 = 364.847$.

Corrections To Harter's Table

ν	$P(\nu|\chi^2)$	E	ν	$P(\nu|\chi^2)$	E	ν	$P(\nu|\chi^2)$	E
-------	-----------------	-----	-------	-----------------	-----	-------	-----------------	-----

Page 138

1	.2000	+1	5	.0005	+1	8	.4000	+1
4	.0250	+1	7	.4000	-1	9	.9950	+1

Page 139

11	.0001	+1	16	.3000	-1	18	.2000	+1
11	.9750	-1	16	.9750	+1	19	.5000	+1
12	.0001	+1	17	.9999	+1	20	.9995	+1
13	.9999	+1	18	.0001	+1			
14	.0100	+1	18	.0500	+1			

Page 140

22	.9950	+1	27	.9900	-1	29	.2000	+1
23	.0005	+1	28	.4000	+1	30	.9990	+1

Page 141

32	.9000	-1	36	.9990	+1	38	.6000	-1
33	.9950	-1	38	.1000	+1	39	.7000	-1
34	.8000	-1	38	.5000	+1	40	.9990	+1

Page 142

42	.9750	+1	44	.9750	+1	47	.9750	-1
43	.1000	+1	44	.9950	+1	49	.9500	-1
44	.2000	-1	45	.9999	+1	50	.9999	-1

Page 143

51	.9990	+1	55	.9950	+1	57	.9950	+1
52	.9500	+1	56	.9750	+1	58	.9950	+1
52	.9750	+1	56	.9950	+1	60	.9990	-1
52	.9990	+1	57	.1000	-1			
53	.9950	+1	57	.9500	-1			

Page 144

61	.2000	-1	64	.9000	+1	68	.1000	+1
62	.9950	+1	65	.9950	-1	68	.2000	-1
64	.9000	-1	66	.2000	-1	70	.8000	-1
64	.9750	+1	67	.8000	-1			

Page 145

71	.1000	+1	74	.9000	-1	76	.3000	+1
72	.9000	-1	74	.9750	-1	76	.9900	+1
73	.9750	+1	76	.1000	+1	80	.8000	-1

Page 146

81	.9990	+1	82	.0050	+1	83	.8000	-1
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Page 147

93	.0250	-1	94	.1000	-1	97	.5000	+1
94	.0001	+1	95	.0010	+1	99	.1000	+1

Corrections To Harter's Table Continued

ν	$P(\nu|\chi^2)$	E	ν	$P(\nu|\chi^2)$	E	ν	$P(\nu|\chi^2)$	E
-------	-----------------	-----	-------	-----------------	-----	-------	-----------------	-----

Page 148

102	.9750	+1	109	.1000	+1			
-----	-------	----	-----	-------	----	--	--	--

Page 149

112	.1000	+1	112	.6000	+1	119	.0001	+1
-----	-------	----	-----	-------	----	-----	-------	----

Page 150

122	.0010	+1	124	.0500	-1			
122	.9950	+1	129	.9500	+1			

Page 151

131	.9995	+1	132	.0100	+1	135	.1000	+1
-----	-------	----	-----	-------	----	-----	-------	----

Page 152

145	.9990	+1						
-----	-------	----	--	--	--	--	--	--

Page 154

174	.0100	+1	184	.0500	-1	188	.9750	+1
174	.3000	+1	184	.1000	-1			

Page 155

192	.2000	-1	196	.0500	+1	200	.0500	+1
192	.9900	+1	196	.9750	+1	208	.0000	+1

Page 156

212	.9950	+1	220	.1000	-1	226	.6000	+1
216	.0500	+1	224	.0500	+1	230	.1000	+1

Page 157

236	.9000	-1	244	.9990	+1			
238	.9995	+1	250	.3000	+1			

Page 158

252	.4000	+1	258	.1000	+1	270	.9995	+1
254	.0005	+1	262	.9950	+1			

Page 159

274	.9750	+1	280	.9750	+1			
276	.9500	+1	280	.9900	+1			

Page 160

300	.9900	-1	304	.9990	+1	306	.9750	-1
302	.0250	-1	306	.0001	+1			

Page 161

312	.0500	+1	318	.9750	+1	322	.9990	+1
314	.9750	+1	322	.9500	-1	328	.0500	-1

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APPENDIX A
TABLE A
PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

PERCENTAGE POINTS OF $Q(\nu|\chi^2)$ -- TABLE A

This appendix contains a table of χ^2 as a function of ν and $Q(\nu|\chi^2)$. It is a much larger table than the ones contained in [1, pp. 984-985], [4, pp. 137-161]. There are 72,000 values of χ^2 tabulated to six correct significant digits with 1200 values of ν and 60 values of $Q(\nu|\chi^2)$ taking the following values:

ν : 0.1(0.1)13(0.2)26(0.25)42.5(0.5)512

Q : 0.999999, 0.999995, 0.99999, 0.99995, 0.9999, 0.9995, 0.999, 0.9975, 0.995, 0.9925, 0.99, 0.9875, 0.985, 0.98 (0.005) 0.95, 0.925, 0.9 (0.05) 0.5, 0.475, 0.45 (0.05) 0.10, 0.075, 0.05 (0.005) 0.015, 0.0125 (0.0025) 0.0025, 0.001, 0.0005, 0.0001, 0.00005, 0.00001, 0.000005, 0.000001.

The values of χ^2 are expressed in normalized form. For example for $Q = .9975$ and $\nu = 1.9$, we have $\chi^2 = .357377 - 02 = .357377 \times 10^{-2}$ or for $Q = .9925$, $\nu = 9.9$ we have $\chi^2 = .233478 - 01 = .233478 \times 10^{-1}$.

An extremely condensed version of this table is given in Appendix B starting on page 164.

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Table with 10 columns of numerical data and 100 rows of entries. The columns are labeled with values: .99500, .99750, .99530, .99250, .99500, .99750, .99530, .99250, .99500, .99750. Each row contains a long alphanumeric string followed by a numerical value in each column.

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

ν	.99999	.99995	.99990	.99950	.99900	.99750	.99500	.99250	.99000
17.00	175512	215118	233955	293950	323515	407087	451274	519697	580976
17.05	168817	202132	216127	261427	333424	416214	460994	530279	592240
17.10	162555	193922	205954	243932	333995	425400	470770	549133	613633
17.15	156719	187594	197582	229582	334641	434641	480661	559599	624633
17.20	151290	181958	190612	218517	335317	443939	490485	569334	634801
17.25	146254	176881	185113	209723	336022	453319	500422	579774	645191
17.30	141500	172322	180959	202959	336753	462698	510411	589952	655813
17.35	137017	168239	177197	197157	337511	472157	520451	599801	666642
17.40	132797	164581	173824	192254	338297	481670	529541	609361	677726
17.45	128825	161394	170902	188241	339111	491234	538781	617636	689039
17.50	125087	158628	168397	185181	339953	500849	548161	626112	700524
17.55	121570	156281	166515	182947	340824	510515	557681	634766	712224
17.60	118269	154349	164994	181477	341724	520230	567334	643581	724181
17.65	115170	152797	163777	180724	342653	529994	577126	652551	736334
17.70	112269	151581	162812	180241	343611	539807	587044	661681	748701
17.75	109547	150658	162047	180009	344597	549667	597091	671033	761281
17.80	107081	149981	161454	180009	345611	559577	607271	680601	774081
17.85	104857	149501	161041	180241	346653	569524	617581	690334	787081
17.90	102869	149197	160781	180681	347724	579511	628011	700181	800241
17.95	101097	149041	160641	181241	348824	589524	638551	710234	814581
18.00	99524	149024	160612	181911	349953	599577	649201	720481	829181
18.05	98047	149141	160741	182681	351111	609667	660061	730934	844881
18.10	96669	149381	160981	183547	352297	619801	671033	741481	860781
18.15	95381	149731	161331	184501	353511	629994	682281	752181	876881
18.20	94181	150181	161781	185547	354753	640230	693781	763034	893181
18.25	93069	150731	162331	186681	356024	650611	705481	774081	909681
18.30	92047	151381	162981	187911	357324	661033	717381	785281	926381
18.35	91119	152131	163731	189241	358653	671511	729381	796681	943281
18.40	90281	152981	164581	190681	360011	682034	741481	808281	960381
18.45	89524	153931	165531	192241	361481	692611	753681	820081	977681
18.50	88847	154981	166581	193911	363053	703230	766081	832081	995181
18.55	88247	156131	167731	195681	364724	713834	778681	844181	101281
18.60	87719	157381	169081	197547	366497	724481	791481	856381	103081
18.65	87269	158731	170531	199501	368371	735181	804481	868681	104881
18.70	86881	160181	172081	201547	370347	745934	817681	881081	106681
18.75	86547	161731	173731	203681	372424	756734	831081	893681	108481
18.80	86269	163381	175481	205911	374611	767581	844681	906381	110281
18.85	86047	165131	177331	208241	376901	778481	858481	919281	112081
18.90	85879	166981	179281	210681	379297	789434	872481	932381	113881
18.95	85757	168931	181331	213241	381797	800434	886681	945681	115681
19.00	85681	170981	183481	215911	384401	811481	901081	959281	117481
19.05	85647	173131	185731	218681	387111	822581	915681	973081	119281
19.10	85657	175381	188081	221547	390924	833734	930481	987081	121081
19.15	85709	177731	190531	224501	394853	844834	945481	1001281	122881
19.20	85791	180181	193081	227547	398897	855934	960681	1015881	124681
19.25	85901	182731	195731	230681	403053	867081	976081	1030681	126481
19.30	86031	185381	198481	233911	407324	878234	991681	1045681	128281
19.35	86181	188131	201331	237241	411701	889434	1007481	1060881	130081
19.40	86347	190981	204281	240681	416181	900681	1022881	1076281	131881
19.45	86529	193931	207331	244147	420761	911934	1038481	1091881	133681
19.50	86724	196981	210481	247701	425441	923281	1054281	1107681	135481
19.55	86931	199931	213731	251347	430224	934734	1070281	1123681	137281
19.60	87147	202981	217081	255081	435111	946281	1086481	1139881	139081
19.65	87379	206131	220531	258911	440097	957934	1102881	1156281	140881
19.70	87624	209381	224081	262847	445181	969681	1119081	1172881	142681
19.75	87881	212731	227731	266881	450361	981534	1135681	1189081	144481
19.80	88147	216181	231481	271011	455641	993481	1152081	1205681	146281
19.85	88424	219731	235331	275241	461024	1005434	1168681	1222481	148081
19.90	88711	223381	239281	279571	466511	1017481	1185481	1239481	149881
19.95	89009	227131	243331	284001	472101	1029634	1202481	1256681	151681
20.00	89317	230981	247481	288647	477797	1041881	1219681	1274081	153481

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and v

Q	99999	99998	99997	99996	99995	99994	99993	99992	99991	99990	99989	99988	99987	99986	99985	99984	99983	99982	99981	99980	99979	99978	99977	99976	99975	99974	99973	99972	99971	99970	99969	99968	99967	99966	99965	99964	99963	99962	99961	99960	99959	99958	99957	99956	99955	99954	99953	99952	99951	99950									
27.00	658275	658274	658273	658272	658271	658270	658269	658268	658267	658266	658265	658264	658263	658262	658261	658260	658259	658258	658257	658256	658255	658254	658253	658252	658251	658250	658249	658248	658247	658246	658245	658244	658243	658242	658241	658240	658239	658238	658237	658236	658235	658234	658233	658232	658231	658230	658229	658228	658227	658226	658225	658224	658223	658222	658221	658220			
27.01	658276	658275	658274	658273	658272	658271	658270	658269	658268	658267	658266	658265	658264	658263	658262	658261	658260	658259	658258	658257	658256	658255	658254	658253	658252	658251	658250	658249	658248	658247	658246	658245	658244	658243	658242	658241	658240	658239	658238	658237	658236	658235	658234	658233	658232	658231	658230	658229	658228	658227	658226	658225	658224	658223	658222	658221	658220		
27.02	658277	658276	658275	658274	658273	658272	658271	658270	658269	658268	658267	658266	658265	658264	658263	658262	658261	658260	658259	658258	658257	658256	658255	658254	658253	658252	658251	658250	658249	658248	658247	658246	658245	658244	658243	658242	658241	658240	658239	658238	658237	658236	658235	658234	658233	658232	658231	658230	658229	658228	658227	658226	658225	658224	658223	658222	658221	658220	
27.03	658278	658277	658276	658275	658274	658273	658272	658271	658270	658269	658268	658267	658266	658265	658264	658263	658262	658261	658260	658259	658258	658257	658256	658255	658254	658253	658252	658251	658250	658249	658248	658247	658246	658245	658244	658243	658242	658241	658240	658239	658238	658237	658236	658235	658234	658233	658232	658231	658230	658229	658228	658227	658226	658225	658224	658223	658222	658221	658220

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and P

P	Q	χ^2	P	Q	χ^2	P	Q	χ^2	P	Q	χ^2	P	Q	χ^2	P	Q	χ^2
07.5	0.24895	26782	0.99989	0.99989	25761	0.99989	0.99989	26782	0.99989	0.99989	25761	0.99989	0.99989	26782	0.99989	0.99989	25761
07.6	0.24914	26801	0.99990	0.99990	25780	0.99990	0.99990	26801	0.99990	0.99990	25780	0.99990	0.99990	26801	0.99990	0.99990	25780
07.7	0.24933	26820	0.99991	0.99991	25799	0.99991	0.99991	26820	0.99991	0.99991	25799	0.99991	0.99991	26820	0.99991	0.99991	25799
07.8	0.24952	26839	0.99992	0.99992	25818	0.99992	0.99992	26839	0.99992	0.99992	25818	0.99992	0.99992	26839	0.99992	0.99992	25818
07.9	0.24971	26858	0.99993	0.99993	25837	0.99993	0.99993	26858	0.99993	0.99993	25837	0.99993	0.99993	26858	0.99993	0.99993	25837
08.0	0.24990	26877	0.99994	0.99994	25856	0.99994	0.99994	26877	0.99994	0.99994	25856	0.99994	0.99994	26877	0.99994	0.99994	25856
08.1	0.25009	26896	0.99995	0.99995	25875	0.99995	0.99995	26896	0.99995	0.99995	25875	0.99995	0.99995	26896	0.99995	0.99995	25875
08.2	0.25028	26915	0.99996	0.99996	25894	0.99996	0.99996	26915	0.99996	0.99996	25894	0.99996	0.99996	26915	0.99996	0.99996	25894
08.3	0.25047	26934	0.99997	0.99997	25913	0.99997	0.99997	26934	0.99997	0.99997	25913	0.99997	0.99997	26934	0.99997	0.99997	25913
08.4	0.25066	26953	0.99998	0.99998	25932	0.99998	0.99998	26953	0.99998	0.99998	25932	0.99998	0.99998	26953	0.99998	0.99998	25932
08.5	0.25085	26972	0.99999	0.99999	25951	0.99999	0.99999	26972	0.99999	0.99999	25951	0.99999	0.99999	26972	0.99999	0.99999	25951
08.6	0.25104	26991	0.99999	0.99999	25970	0.99999	0.99999	26991	0.99999	0.99999	25970	0.99999	0.99999	26991	0.99999	0.99999	25970
08.7	0.25123	27010	0.99999	0.99999	25989	0.99999	0.99999	27010	0.99999	0.99999	25989	0.99999	0.99999	27010	0.99999	0.99999	25989
08.8	0.25142	27029	0.99999	0.99999	26008	0.99999	0.99999	27029	0.99999	0.99999	26008	0.99999	0.99999	27029	0.99999	0.99999	26008
08.9	0.25161	27048	0.99999	0.99999	26027	0.99999	0.99999	27048	0.99999	0.99999	26027	0.99999	0.99999	27048	0.99999	0.99999	26027
09.0	0.25180	27067	0.99999	0.99999	26046	0.99999	0.99999	27067	0.99999	0.99999	26046	0.99999	0.99999	27067	0.99999	0.99999	26046
09.1	0.25199	27086	0.99999	0.99999	26065	0.99999	0.99999	27086	0.99999	0.99999	26065	0.99999	0.99999	27086	0.99999	0.99999	26065
09.2	0.25218	27105	0.99999	0.99999	26084	0.99999	0.99999	27105	0.99999	0.99999	26084	0.99999	0.99999	27105	0.99999	0.99999	26084
09.3	0.25237	27124	0.99999	0.99999	26103	0.99999	0.99999	27124	0.99999	0.99999	26103	0.99999	0.99999	27124	0.99999	0.99999	26103
09.4	0.25256	27143	0.99999	0.99999	26122	0.99999	0.99999	27143	0.99999	0.99999	26122	0.99999	0.99999	27143	0.99999	0.99999	26122
09.5	0.25275	27162	0.99999	0.99999	26141	0.99999	0.99999	27162	0.99999	0.99999	26141	0.99999	0.99999	27162	0.99999	0.99999	26141
09.6	0.25294	27181	0.99999	0.99999	26160	0.99999	0.99999	27181	0.99999	0.99999	26160	0.99999	0.99999	27181	0.99999	0.99999	26160
09.7	0.25313	27200	0.99999	0.99999	26179	0.99999	0.99999	27200	0.99999	0.99999	26179	0.99999	0.99999	27200	0.99999	0.99999	26179
09.8	0.25332	27219	0.99999	0.99999	26198	0.99999	0.99999	27219	0.99999	0.99999	26198	0.99999	0.99999	27219	0.99999	0.99999	26198
09.9	0.25351	27238	0.99999	0.99999	26217	0.99999	0.99999	27238	0.99999	0.99999	26217	0.99999	0.99999	27238	0.99999	0.99999	26217
10.0	0.25370	27257	0.99999	0.99999	26236	0.99999	0.99999	27257	0.99999	0.99999	26236	0.99999	0.99999	27257	0.99999	0.99999	26236

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and v

Q	.99998	.99997	.99995	.99990	.99980	.99950	.99900	.99750	.99500	.99250
227.6	.18792	.18793	.18795	.18798	.18801	.18805	.18810	.18816	.18822	.18828
227.7	.18794	.18795	.18797	.18800	.18803	.18807	.18812	.18818	.18824	.18830
227.8	.18796	.18797	.18799	.18802	.18805	.18809	.18814	.18820	.18826	.18832
227.9	.18798	.18799	.18801	.18804	.18807	.18811	.18816	.18822	.18828	.18834
228.0	.18800	.18801	.18803	.18806	.18809	.18813	.18818	.18824	.18830	.18836
228.1	.18802	.18803	.18805	.18808	.18811	.18815	.18820	.18826	.18832	.18838
228.2	.18804	.18805	.18807	.18810	.18813	.18817	.18822	.18828	.18834	.18840
228.3	.18806	.18807	.18809	.18812	.18815	.18819	.18824	.18830	.18836	.18842
228.4	.18808	.18809	.18811	.18814	.18817	.18821	.18826	.18832	.18838	.18844
228.5	.18810	.18811	.18813	.18816	.18819	.18823	.18828	.18834	.18840	.18846
228.6	.18812	.18813	.18815	.18818	.18821	.18825	.18830	.18836	.18842	.18848
228.7	.18814	.18815	.18817	.18820	.18823	.18827	.18832	.18838	.18844	.18850
228.8	.18816	.18817	.18819	.18822	.18825	.18829	.18834	.18840	.18846	.18852
228.9	.18818	.18819	.18821	.18824	.18827	.18831	.18836	.18842	.18848	.18854
229.0	.18820	.18821	.18823	.18826	.18829	.18833	.18838	.18844	.18850	.18856
229.1	.18822	.18823	.18825	.18828	.18831	.18835	.18840	.18846	.18852	.18858
229.2	.18824	.18825	.18827	.18830	.18833	.18837	.18842	.18848	.18854	.18860
229.3	.18826	.18827	.18829	.18832	.18835	.18839	.18844	.18850	.18856	.18862
229.4	.18828	.18829	.18831	.18834	.18837	.18841	.18846	.18852	.18858	.18864
229.5	.18830	.18831	.18833	.18836	.18839	.18843	.18848	.18854	.18860	.18866
229.6	.18832	.18833	.18835	.18838	.18841	.18845	.18850	.18856	.18862	.18868
229.7	.18834	.18835	.18837	.18840	.18843	.18847	.18852	.18858	.18864	.18870
229.8	.18836	.18837	.18839	.18842	.18845	.18849	.18854	.18860	.18866	.18872
229.9	.18838	.18839	.18841	.18844	.18847	.18851	.18856	.18862	.18868	.18874
230.0	.18840	.18841	.18843	.18846	.18849	.18853	.18858	.18864	.18870	.18876

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Percentage Points of the 1% Distribution
Values of Z from 0.0 to 2.0 and F

Z	0.99999	0.99992	0.99985	0.99980	0.99950	0.99900	0.99750	0.99500	0.99250
0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.1	0.0398	0.0396	0.0394	0.0392	0.0389	0.0386	0.0384	0.0381	0.0378
0.2	0.0793	0.0789	0.0786	0.0783	0.0778	0.0774	0.0770	0.0766	0.0762
0.3	0.1191	0.1187	0.1183	0.1179	0.1173	0.1168	0.1164	0.1159	0.1154
0.4	0.1587	0.1582	0.1577	0.1572	0.1564	0.1559	0.1554	0.1549	0.1544
0.5	0.1985	0.1979	0.1973	0.1967	0.1957	0.1948	0.1939	0.1930	0.1921
0.6	0.2389	0.2382	0.2375	0.2368	0.2356	0.2345	0.2335	0.2325	0.2315
0.7	0.2793	0.2785	0.2777	0.2769	0.2755	0.2743	0.2732	0.2721	0.2711
0.8	0.3199	0.3190	0.3181	0.3172	0.3156	0.3143	0.3131	0.3119	0.3107
0.9	0.3599	0.3589	0.3579	0.3569	0.3551	0.3536	0.3521	0.3506	0.3491
1.0	0.3994	0.3983	0.3972	0.3961	0.3939	0.3921	0.3903	0.3885	0.3867
1.1	0.4382	0.4371	0.4359	0.4347	0.4323	0.4303	0.4283	0.4263	0.4243
1.2	0.4761	0.4749	0.4736	0.4723	0.4697	0.4675	0.4653	0.4631	0.4609
1.3	0.5130	0.5117	0.5104	0.5091	0.5063	0.5039	0.5015	0.4991	0.4967
1.4	0.5491	0.5477	0.5463	0.5449	0.5418	0.5392	0.5366	0.5340	0.5314
1.5	0.5848	0.5833	0.5818	0.5803	0.5770	0.5743	0.5716	0.5688	0.5661
1.6	0.6199	0.6184	0.6168	0.6152	0.6117	0.6088	0.6060	0.6032	0.6003
1.7	0.6554	0.6538	0.6521	0.6504	0.6467	0.6437	0.6407	0.6377	0.6347
1.8	0.6915	0.6898	0.6880	0.6862	0.6823	0.6791	0.6759	0.6727	0.6695
1.9	0.7274	0.7256	0.7237	0.7218	0.7178	0.7144	0.7110	0.7076	0.7042
2.0	0.7643	0.7624	0.7604	0.7584	0.7543	0.7507	0.7471	0.7434	0.7397

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

ν	Q	950000	950010	950020	950030	950040	950050	950060	950070	950080	950090	950100
6.1	0.005	6.6257	6.6470	6.6683	6.6896	6.7109	6.7322	6.7535	6.7748	6.7961	6.8174	6.8387
6.2	0.005	6.7007	6.7220	6.7433	6.7646	6.7859	6.8072	6.8285	6.8498	6.8711	6.8924	6.9137
6.3	0.005	6.7757	6.7970	6.8183	6.8396	6.8609	6.8822	6.9035	6.9248	6.9461	6.9674	6.9887
6.4	0.005	6.8507	6.8720	6.8933	6.9146	6.9359	6.9572	6.9785	6.9998	1.0211	1.0424	1.0637
6.5	0.005	6.9257	6.9470	6.9683	6.9896	7.0109	7.0322	7.0535	7.0748	7.0961	7.1174	7.1387
6.6	0.005	7.0007	7.0220	7.0433	7.0646	7.0859	7.1072	7.1285	7.1498	7.1711	7.1924	7.2137
6.7	0.005	7.0757	7.0970	7.1183	7.1396	7.1609	7.1822	7.2035	7.2248	7.2461	7.2674	7.2887
6.8	0.005	7.1507	7.1720	7.1933	7.2146	7.2359	7.2572	7.2785	7.2998	7.3211	7.3424	7.3637
6.9	0.005	7.2257	7.2470	7.2683	7.2896	7.3109	7.3322	7.3535	7.3748	7.3961	7.4174	7.4387
7.0	0.005	7.3007	7.3220	7.3433	7.3646	7.3859	7.4072	7.4285	7.4498	7.4711	7.4924	7.5137
7.1	0.005	7.3757	7.3970	7.4183	7.4396	7.4609	7.4822	7.5035	7.5248	7.5461	7.5674	7.5887
7.2	0.005	7.4507	7.4720	7.4933	7.5146	7.5359	7.5572	7.5785	7.5998	7.6211	7.6424	7.6637
7.3	0.005	7.5257	7.5470	7.5683	7.5896	7.6109	7.6322	7.6535	7.6748	7.6961	7.7174	7.7387
7.4	0.005	7.6007	7.6220	7.6433	7.6646	7.6859	7.7072	7.7285	7.7498	7.7711	7.7924	7.8137
7.5	0.005	7.6757	7.6970	7.7183	7.7396	7.7609	7.7822	7.8035	7.8248	7.8461	7.8674	7.8887
7.6	0.005	7.7507	7.7720	7.7933	7.8146	7.8359	7.8572	7.8785	7.8998	7.9211	7.9424	7.9637
7.7	0.005	7.8257	7.8470	7.8683	7.8896	7.9109	7.9322	7.9535	7.9748	7.9961	8.0174	8.0387
7.8	0.005	7.9007	7.9220	7.9433	7.9646	7.9859	8.0072	8.0285	8.0498	8.0711	8.0924	8.1137
7.9	0.005	7.9757	7.9970	8.0183	8.0396	8.0609	8.0822	8.1035	8.1248	8.1461	8.1674	8.1887
8.0	0.005	8.0507	8.0720	8.0933	8.1146	8.1359	8.1572	8.1785	8.1998	8.2211	8.2424	8.2637

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and r

Q	r	0.95000	0.96000	0.95000	0.96000	0.95000	0.96000	0.95000	0.96000	0.95000	0.96000
10.0	0.95	36.197	37.578	36.197	37.578	36.197	37.578	36.197	37.578	36.197	37.578
10.1	0.95	36.227	37.608	36.227	37.608	36.227	37.608	36.227	37.608	36.227	37.608
10.2	0.95	36.258	37.639	36.258	37.639	36.258	37.639	36.258	37.639	36.258	37.639
10.3	0.95	36.289	37.670	36.289	37.670	36.289	37.670	36.289	37.670	36.289	37.670
10.4	0.95	36.320	37.701	36.320	37.701	36.320	37.701	36.320	37.701	36.320	37.701
10.5	0.95	36.351	37.732	36.351	37.732	36.351	37.732	36.351	37.732	36.351	37.732
10.6	0.95	36.382	37.763	36.382	37.763	36.382	37.763	36.382	37.763	36.382	37.763
10.7	0.95	36.413	37.794	36.413	37.794	36.413	37.794	36.413	37.794	36.413	37.794
10.8	0.95	36.444	37.825	36.444	37.825	36.444	37.825	36.444	37.825	36.444	37.825
10.9	0.95	36.475	37.856	36.475	37.856	36.475	37.856	36.475	37.856	36.475	37.856
11.0	0.95	36.506	37.887	36.506	37.887	36.506	37.887	36.506	37.887	36.506	37.887
11.1	0.95	36.537	37.918	36.537	37.918	36.537	37.918	36.537	37.918	36.537	37.918
11.2	0.95	36.568	37.949	36.568	37.949	36.568	37.949	36.568	37.949	36.568	37.949
11.3	0.95	36.599	37.980	36.599	37.980	36.599	37.980	36.599	37.980	36.599	37.980
11.4	0.95	36.630	38.011	36.630	38.011	36.630	38.011	36.630	38.011	36.630	38.011
11.5	0.95	36.661	38.042	36.661	38.042	36.661	38.042	36.661	38.042	36.661	38.042
11.6	0.95	36.692	38.073	36.692	38.073	36.692	38.073	36.692	38.073	36.692	38.073
11.7	0.95	36.723	38.104	36.723	38.104	36.723	38.104	36.723	38.104	36.723	38.104
11.8	0.95	36.754	38.135	36.754	38.135	36.754	38.135	36.754	38.135	36.754	38.135
11.9	0.95	36.785	38.166	36.785	38.166	36.785	38.166	36.785	38.166	36.785	38.166
12.0	0.95	36.816	38.197	36.816	38.197	36.816	38.197	36.816	38.197	36.816	38.197
12.1	0.95	36.847	38.228	36.847	38.228	36.847	38.228	36.847	38.228	36.847	38.228
12.2	0.95	36.878	38.259	36.878	38.259	36.878	38.259	36.878	38.259	36.878	38.259
12.3	0.95	36.909	38.290	36.909	38.290	36.909	38.290	36.909	38.290	36.909	38.290
12.4	0.95	36.940	38.321	36.940	38.321	36.940	38.321	36.940	38.321	36.940	38.321
12.5	0.95	36.971	38.352	36.971	38.352	36.971	38.352	36.971	38.352	36.971	38.352
12.6	0.95	37.002	38.383	37.002	38.383	37.002	38.383	37.002	38.383	37.002	38.383
12.7	0.95	37.033	38.414	37.033	38.414	37.033	38.414	37.033	38.414	37.033	38.414
12.8	0.95	37.064	38.445	37.064	38.445	37.064	38.445	37.064	38.445	37.064	38.445
12.9	0.95	37.095	38.476	37.095	38.476	37.095	38.476	37.095	38.476	37.095	38.476
13.0	0.95	37.126	38.507	37.126	38.507	37.126	38.507	37.126	38.507	37.126	38.507
13.1	0.95	37.157	38.538	37.157	38.538	37.157	38.538	37.157	38.538	37.157	38.538
13.2	0.95	37.188	38.569	37.188	38.569	37.188	38.569	37.188	38.569	37.188	38.569
13.3	0.95	37.219	38.600	37.219	38.600	37.219	38.600	37.219	38.600	37.219	38.600
13.4	0.95	37.250	38.631	37.250	38.631	37.250	38.631	37.250	38.631	37.250	38.631
13.5	0.95	37.281	38.662	37.281	38.662	37.281	38.662	37.281	38.662	37.281	38.662
13.6	0.95	37.312	38.693	37.312	38.693	37.312	38.693	37.312	38.693	37.312	38.693
13.7	0.95	37.343	38.724	37.343	38.724	37.343	38.724	37.343	38.724	37.343	38.724
13.8	0.95	37.374	38.755	37.374	38.755	37.374	38.755	37.374	38.755	37.374	38.755
13.9	0.95	37.405	38.786	37.405	38.786	37.405	38.786	37.405	38.786	37.405	38.786
14.0	0.95	37.436	38.817	37.436	38.817	37.436	38.817	37.436	38.817	37.436	38.817
14.1	0.95	37.467	38.848	37.467	38.848	37.467	38.848	37.467	38.848	37.467	38.848
14.2	0.95	37.498	38.879	37.498	38.879	37.498	38.879	37.498	38.879	37.498	38.879
14.3	0.95	37.529	38.910	37.529	38.910	37.529	38.910	37.529	38.910	37.529	38.910
14.4	0.95	37.560	38.941	37.560	38.941	37.560	38.941	37.560	38.941	37.560	38.941
14.5	0.95	37.591	38.972	37.591	38.972	37.591	38.972	37.591	38.972	37.591	38.972
14.6	0.95	37.622	39.003	37.622	39.003	37.622	39.003	37.622	39.003	37.622	39.003
14.7	0.95	37.653	39.034	37.653	39.034	37.653	39.034	37.653	39.034	37.653	39.034
14.8	0.95	37.684	39.065	37.684	39.065	37.684	39.065	37.684	39.065	37.684	39.065
14.9	0.95	37.715	39.096	37.715	39.096	37.715	39.096	37.715	39.096	37.715	39.096
15.0	0.95	37.746	39.127	37.746	39.127	37.746	39.127	37.746	39.127	37.746	39.127

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and p

Q	.950000	.975000	.965000	.970000	.965000	.963000	.955000	.950000
17.50	65629	71697	73244	73678	82283	84273	85282	86186
17.51	66822	72922	74533	75000	83863	85863	86872	87811
17.52	68073	74377	76033	76533	85463	87463	88482	89455
17.53	69382	75867	77566	78095	87063	89063	90093	91020
17.54	70747	77397	79133	79686	88663	90663	91703	92637
17.55	72172	78967	80866	81441	90263	92263	93313	94247
18.00	72172	78967	80866	81441	90263	92263	93313	94247
18.01	73229	80022	81966	82566	91363	93363	94413	95347
18.02	74377	81133	83133	83766	92463	94463	95513	96447
18.03	75533	82244	84244	84895	93563	95563	96613	97547
18.04	76747	83377	85377	86041	94663	96663	97713	98647
18.05	77997	84533	86533	87213	95763	97763	98813	99747
18.06	79267	85707	87707	88401	96863	98863	99913	100847
18.07	80547	86897	88897	89601	97963	99963	101013	101947
18.08	81837	88107	90107	90821	99063	101063	102113	103047
18.09	83137	89327	91327	92051	100163	102163	103213	104147
18.10	84447	90557	92557	93286	101263	103263	104313	105247
18.11	85767	91797	93797	94533	102363	104363	105413	106347
18.12	87097	93047	95047	95786	103463	105463	106513	107447
18.13	88437	94307	96307	97041	104563	106563	107613	108547
18.14	89787	95577	97577	98301	105663	107663	108713	109647
18.15	91147	96857	98857	99566	106763	108763	109813	110747
18.16	92507	98137	100137	100833	107863	109863	110913	111847
18.17	93867	99417	101417	102033	108963	110963	112013	112947
18.18	95227	100697	102697	103233	110063	112063	113113	114047
18.19	96587	101977	103977	104433	111163	113163	114213	115147
18.20	97947	103257	105257	105633	112263	114263	115313	116247
18.21	99307	104537	106537	106833	113363	115363	116413	117347
18.22	100667	105817	107817	108033	114463	116463	117513	118447
18.23	102027	107097	109097	109233	115563	117563	118613	119547
18.24	103387	108377	110377	110433	116663	118663	119713	120647
18.25	104747	109657	111657	111633	117763	119763	120813	121747
18.26	106107	110937	112937	112833	118863	120863	121913	122847
18.27	107467	112217	114217	114033	119963	121963	123013	123947
18.28	108827	113497	115497	115233	121063	123063	124113	125047
18.29	110187	114777	116777	116433	122163	124163	125213	126147
18.30	111547	116057	118057	117633	123263	125263	126313	127247
18.31	112907	117337	119337	118833	124363	126363	127413	128347
18.32	114267	118617	120617	120033	125463	127463	128513	129447
18.33	115627	119897	121897	121233	126563	128563	129613	130547
18.34	116987	121177	123177	122433	127663	129663	130713	131647
18.35	118347	122457	124457	123633	128763	130763	131813	132747
18.36	119707	123737	125737	124833	129863	131863	132913	133847
18.37	121067	125017	127017	126033	130963	132963	134013	134947
18.38	122427	126297	128297	127233	132063	134063	135113	136047
18.39	123787	127577	129577	128433	133163	135163	136213	137147
18.40	125147	128857	130857	129633	134263	136263	137313	138247
18.41	126507	130137	132137	130833	135363	137363	138413	139347
18.42	127867	131417	133417	132033	136463	138463	139513	140447
18.43	129227	132697	134697	133233	137563	139563	140613	141547
18.44	130587	133977	135977	134433	138663	140663	141713	142647
18.45	131947	135257	137257	135633	139763	141763	142813	143747
18.46	133307	136537	138537	136833	140863	142863	143913	144847
18.47	134667	137817	139817	138033	141963	143963	145013	145947
18.48	136027	139097	141097	139233	143063	145063	146113	147047
18.49	137387	140377	142377	140433	144163	146163	147213	148147
18.50	138747	141657	143657	141633	145263	147263	148313	149247

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and ν

ν	.995000	.997500	.998000	.997500	.970000	.955000	.960000	.955000	.950000
162.5	123522 03	124793 03	125673 03	129097 03	130324 03	131398 03	132357 03	133226 03	134027 03
163.0	123497 03	124768 03	125648 03	129072 03	130299 03	131373 03	132332 03	133201 03	133981 03
163.5	123472 03	124743 03	125623 03	129047 03	130274 03	131348 03	132303 03	133172 03	133952 03
164.0	123447 03	124718 03	125598 03	129022 03	130249 03	131323 03	132278 03	133147 03	133927 03
164.5	123422 03	124693 03	125573 03	128997 03	130224 03	131298 03	132253 03	133122 03	133902 03
165.0	123397 03	124668 03	125548 03	128972 03	130199 03	131273 03	132228 03	133097 03	133877 03
165.5	123372 03	124643 03	125523 03	128947 03	130174 03	131248 03	132203 03	133072 03	133852 03
166.0	123347 03	124618 03	125498 03	128922 03	130149 03	131223 03	132178 03	133047 03	133827 03
166.5	123322 03	124593 03	125473 03	128897 03	130124 03	131198 03	132153 03	133022 03	133802 03
167.0	123297 03	124568 03	125448 03	128872 03	130099 03	131173 03	132128 03	132997 03	133777 03
167.5	123272 03	124543 03	125423 03	128847 03	130074 03	131148 03	132103 03	132972 03	133752 03
168.0	123247 03	124518 03	125398 03	128822 03	130049 03	131123 03	132078 03	132947 03	133727 03
168.5	123222 03	124493 03	125373 03	128797 03	130024 03	131098 03	132053 03	132922 03	133702 03
169.0	123197 03	124468 03	125348 03	128772 03	130000 03	131073 03	132028 03	132897 03	133677 03
169.5	123172 03	124443 03	125323 03	128747 03	129975 03	131048 03	132003 03	132872 03	133652 03
170.0	123147 03	124418 03	125298 03	128722 03	129950 03	131023 03	131978 03	132847 03	133627 03
170.5	123122 03	124393 03	125273 03	128697 03	129925 03	130998 03	131953 03	132822 03	133602 03
171.0	123097 03	124368 03	125248 03	128672 03	129900 03	130973 03	131928 03	132797 03	133577 03
171.5	123072 03	124343 03	125223 03	128647 03	129875 03	130948 03	131903 03	132772 03	133552 03
172.0	123047 03	124318 03	125198 03	128622 03	129850 03	130923 03	131878 03	132747 03	133527 03
172.5	123022 03	124293 03	125173 03	128597 03	129825 03	130898 03	131853 03	132722 03	133502 03
173.0	122997 03	124268 03	125148 03	128572 03	129800 03	130873 03	131828 03	132697 03	133477 03
173.5	122972 03	124243 03	125123 03	128547 03	129775 03	130848 03	131803 03	132672 03	133452 03
174.0	122947 03	124218 03	125098 03	128522 03	129750 03	130823 03	131778 03	132647 03	133427 03
174.5	122922 03	124193 03	125073 03	128497 03	129725 03	130798 03	131753 03	132622 03	133402 03
175.0	122897 03	124168 03	125048 03	128472 03	129700 03	130773 03	131728 03	132597 03	133377 03
175.5	122872 03	124143 03	125023 03	128447 03	129675 03	130748 03	131703 03	132572 03	133352 03
176.0	122847 03	124118 03	124998 03	128422 03	129650 03	130723 03	131678 03	132547 03	133327 03
176.5	122822 03	124093 03	124973 03	128397 03	129625 03	130698 03	131653 03	132522 03	133302 03
177.0	122797 03	124068 03	124948 03	128372 03	129600 03	130673 03	131628 03	132497 03	133277 03
177.5	122772 03	124043 03	124923 03	128347 03	129575 03	130648 03	131603 03	132472 03	133252 03
178.0	122747 03	124018 03	124898 03	128322 03	129550 03	130623 03	131578 03	132447 03	133227 03
178.5	122722 03	123993 03	124873 03	128297 03	129525 03	130598 03	131553 03	132422 03	133202 03
179.0	122697 03	123968 03	124848 03	128272 03	129500 03	130573 03	131528 03	132397 03	133177 03
179.5	122672 03	123943 03	124823 03	128247 03	129475 03	130548 03	131503 03	132372 03	133152 03
180.0	122647 03	123918 03	124798 03	128222 03	129450 03	130523 03	131478 03	132347 03	133127 03
180.5	122622 03	123893 03	124773 03	128197 03	129425 03	130498 03	131453 03	132322 03	133102 03
181.0	122597 03	123868 03	124748 03	128172 03	129400 03	130473 03	131428 03	132297 03	133077 03
181.5	122572 03	123843 03	124723 03	128147 03	129375 03	130448 03	131403 03	132272 03	133052 03
182.0	122547 03	123818 03	124698 03	128122 03	129350 03	130423 03	131378 03	132247 03	133027 03
182.5	122522 03	123793 03	124673 03	128097 03	129325 03	130398 03	131353 03	132222 03	133002 03
183.0	122497 03	123768 03	124648 03	128072 03	129300 03	130373 03	131328 03	132197 03	132977 03
183.5	122472 03	123743 03	124623 03	128047 03	129275 03	130348 03	131303 03	132172 03	132952 03
184.0	122447 03	123718 03	124598 03	128022 03	129250 03	130323 03	131278 03	132147 03	132927 03
184.5	122422 03	123693 03	124573 03	127997 03	129225 03	130298 03	131253 03	132122 03	132902 03
185.0	122397 03	123668 03	124548 03	127972 03	129200 03	130273 03	131228 03	132097 03	132877 03
185.5	122372 03	123643 03	124523 03	127947 03	129175 03	130248 03	131203 03	132072 03	132852 03
186.0	122347 03	123618 03	124498 03	127922 03	129150 03	130223 03	131178 03	132047 03	132827 03
186.5	122322 03	123593 03	124473 03	127897 03	129125 03	130198 03	131153 03	132022 03	132802 03
187.0	122297 03	123568 03	124448 03	127872 03	129100 03	130173 03	131128 03	131997 03	132777 03

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and p

	.995000	.990000	.975000	.970000	.965000	.960000	.955000	.950000
287.5	234673 03	234554 03	242424 03	244121 03	245604 03	246928 03	248127 03	249227 03
288.0	235124 03	235005 03	242883 03	244582 03	246067 03	247391 03	248592 03	249692 03
288.5	235575 03	235456 03	243342 03	245043 03	246528 03	247852 03	249053 03	250153 03
289.0	236026 03	235907 03	243801 03	245504 03	246991 03	248316 03	249521 03	250624 03
289.5	236477 03	236358 03	244260 03	245964 03	247453 03	248782 03	249986 03	251090 03
290.0	236928 03	236809 03	244720 03	246425 03	247916 03	249246 03	250451 03	251536 03
290.5	237379 03	237260 03	245179 03	246886 03	248378 03	249709 03	250916 03	252022 03
291.0	237830 03	237711 03	245638 03	247347 03	248841 03	250173 03	251380 03	252488 03
291.5	238281 03	238162 03	246098 03	247808 03	249303 03	250637 03	251845 03	252953 03
292.0	238732 03	238613 03	246557 03	248269 03	249765 03	251100 03	252310 03	253419 03
292.5	239183 03	239064 03	247017 03	248730 03	250228 03	251564 03	252775 03	253885 03
293.0	239634 03	239515 03	247476 03	249191 03	250691 03	252026 03	253240 03	254351 03
293.5	240085 03	239966 03	247936 03	249653 03	251153 03	252492 03	253705 03	254817 03
294.0	240536 03	240417 03	248395 03	250114 03	251616 03	252956 03	254170 03	255283 03
294.5	240987 03	240868 03	248855 03	250575 03	252078 03	253420 03	254635 03	255749 03
295.0	241438 03	241319 03	249314 03	251036 03	252541 03	253884 03	255100 03	256216 03
295.5	241889 03	241770 03	249774 03	251497 03	253004 03	254347 03	255565 03	256682 03
296.0	242340 03	242221 03	250234 03	251959 03	253466 03	254811 03	256030 03	257148 03
296.5	242791 03	242672 03	250693 03	252420 03	253929 03	255275 03	256495 03	257614 03
297.0	243242 03	243123 03	251153 03	252882 03	254392 03	255740 03	256961 03	258080 03
297.5	243693 03	243574 03	251613 03	253343 03	254855 03	256204 03	257426 03	258546 03
298.0	244144 03	244025 03	252073 03	253804 03	255318 03	256668 03	257891 03	259013 03
298.5	244595 03	244476 03	252533 03	254266 03	255780 03	257132 03	258356 03	259479 03
299.0	245046 03	244927 03	252992 03	254727 03	256243 03	257596 03	258822 03	259945 03
299.5	245497 03	245378 03	253452 03	255189 03	256706 03	258060 03	259287 03	260412 03
300.0	245948 03	245829 03	253912 03	255650 03	257169 03	258524 03	259752 03	260878 03
300.5	246399 03	246280 03	254372 03	256112 03	257632 03	258989 03	260218 03	261345 03
301.0	246850 03	246731 03	254832 03	256574 03	258095 03	259453 03	260683 03	261811 03
301.5	247301 03	247182 03	255292 03	257035 03	258558 03	259917 03	261148 03	262277 03
302.0	247752 03	247633 03	255752 03	257497 03	259022 03	260382 03	261614 03	262744 03
302.5	248203 03	248084 03	256213 03	257959 03	259485 03	260846 03	262079 03	263210 03
303.0	248654 03	248535 03	256673 03	258421 03	259948 03	261310 03	262545 03	263677 03
303.5	249105 03	248986 03	257133 03	258882 03	260411 03	261775 03	263010 03	264144 03
304.0	249556 03	249437 03	257593 03	259344 03	260874 03	262239 03	263476 03	264610 03
304.5	250007 03	249888 03	258053 03	259806 03	261337 03	262704 03	263942 03	265077 03
305.0	250458 03	250339 03	258514 03	260268 03	261801 03	263168 03	264407 03	265544 03
305.5	250909 03	250790 03	258974 03	260730 03	262264 03	263633 03	264873 03	266010 03
306.0	251360 03	251241 03	259434 03	261192 03	262727 03	264097 03	265339 03	266477 03
306.5	251811 03	251692 03	259895 03	261654 03	263191 03	264562 03	265804 03	266944 03
307.0	252262 03	252143 03	260355 03	262116 03	263654 03	265027 03	266270 03	267410 03
307.5	252713 03	252594 03	260816 03	262578 03	264118 03	265491 03	266736 03	267877 03
308.0	253164 03	253045 03	261276 03	263040 03	264581 03	265956 03	267202 03	268344 03
308.5	253615 03	253496 03	261737 03	263502 03	265045 03	266421 03	267668 03	268811 03
309.0	254066 03	253947 03	262197 03	263964 03	265508 03	266885 03	268133 03	269278 03
309.5	254517 03	254398 03	262658 03	264426 03	265972 03	267350 03	268599 03	269745 03
310.0	254968 03	254849 03	263118 03	264888 03	266435 03	267815 03	269065 03	270212 03
310.5	255419 03	255300 03	263579 03	265350 03	266899 03	268280 03	269531 03	270679 03
311.0	255870 03	255751 03	264040 03	265812 03	267362 03	268745 03	269997 03	271146 03
311.5	256321 03	256202 03	264500 03	266275 03	267826 03	269210 03	270463 03	271613 03
312.0	256772 03	256653 03	264961 03	266738 03	268290 03	269675 03	270929 03	272080 03

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

r/Q	.990000	.987500	.985000	.980000	.975000	.970000	.965000	.960000	.955000	.950000
412.5	348635 03	350819 03	352660 03	355677 03	358122 03	360195 03	362004 03	363618 03	365080 03	366419 03
413.0	349094 03	351280 03	353122 03	356141 03	358588 03	360662 03	362473 03	364088 03	365550 03	366891 03
413.5	349554 03	351741 03	353584 03	356603 03	359050 03	361129 03	362941 03	364557 03	366021 03	367362 03
414.0	350014 03	352202 03	354047 03	357070 03	359520 03	361596 03	363410 03	365027 03	366491 03	367833 03
414.5	350473 03	352663 03	354509 03	357534 03	359986 03	362064 03	363878 03	365496 03	366962 03	368305 03
415.0	350933 03	353124 03	354971 03	357999 03	360451 03	362531 03	364347 03	365966 03	367432 03	368776 03
415.5	351392 03	353585 03	355434 03	358463 03	360917 03	362998 03	364815 03	366436 03	367903 03	369248 03
416.0	351852 03	354047 03	355896 03	358927 03	361383 03	363466 03	365284 03	366905 03	368373 03	369719 03
416.5	352312 03	354508 03	356358 03	359392 03	361849 03	363933 03	365753 03	367375 03	368844 03	370191 03
417.0	352771 03	354969 03	356821 03	359856 03	362316 03	364401 03	366221 03	367845 03	369315 03	370662 03
417.5	353231 03	355430 03	357283 03	360321 03	362782 03	364868 03	366690 03	368314 03	369785 03	371134 03
418.0	353691 03	355891 03	357746 03	360785 03	363248 03	365335 03	367158 03	368784 03	370256 03	371605 03
418.5	354151 03	356353 03	358209 03	361249 03	363714 03	365803 03	367627 03	369254 03	370727 03	372077 03
419.0	354610 03	356814 03	358671 03	361714 03	364180 03	366270 03	368096 03	369723 03	371197 03	372548 03
419.5	355070 03	357275 03	359133 03	362179 03	364646 03	366738 03	368564 03	370193 03	371666 03	373020 03
420.0	355530 03	357736 03	359596 03	362643 03	365112 03	367205 03	369033 03	370663 03	372139 03	373491 03
420.5	355990 03	358198 03	360058 03	363108 03	365578 03	367673 03	369502 03	371133 03	372609 03	373963 03
421.0	356450 03	358659 03	360521 03	363572 03	366045 03	368141 03	369971 03	371603 03	373080 03	374435 03
421.5	356910 03	359120 03	360983 03	364037 03	366511 03	368608 03	370439 03	372072 03	373551 03	374906 03
422.0	357370 03	359582 03	361446 03	364501 03	366977 03	369076 03	370908 03	372542 03	374022 03	375378 03
422.5	357830 03	360043 03	361909 03	364966 03	367443 03	369543 03	371377 03	373012 03	374493 03	375850 03
423.0	358290 03	360505 03	362371 03	365431 03	367910 03	370011 03	371846 03	373482 03	374963 03	376321 03
423.5	358750 03	360966 03	362834 03	365895 03	368376 03	370479 03	372315 03	373952 03	375434 03	376793 03
424.0	359210 03	361428 03	363297 03	366360 03	368842 03	370946 03	372784 03	374422 03	375905 03	377265 03
424.5	359670 03	361889 03	363760 03	366825 03	369309 03	371414 03	373252 03	374892 03	376376 03	377737 03
425.0	360130 03	362351 03	364222 03	367290 03	369775 03	371882 03	373721 03	375362 03	376847 03	378208 03
425.5	360590 03	362812 03	364685 03	367754 03	370241 03	372350 03	374190 03	375832 03	377318 03	378680 03
426.0	361050 03	363274 03	365148 03	368219 03	370708 03	372817 03	374655 03	376302 03	377789 03	379152 03
426.5	361510 03	363736 03	365611 03	368684 03	371174 03	373285 03	375128 03	376772 03	378260 03	379624 03
427.0	361970 03	364197 03	366074 03	369149 03	371641 03	373753 03	375597 03	377242 03	378731 03	380096 03
427.5	362431 03	364659 03	366536 03	369614 03	372107 03	374221 03	376066 03	377712 03	379202 03	380567 03
428.0	362891 03	365120 03	366999 03	370079 03	372574 03	374688 03	376535 03	378182 03	379673 03	381039 03
428.5	363351 03	365582 03	367462 03	370544 03	373040 03	375156 03	377004 03	378652 03	380144 03	381511 03
429.0	363811 03	366044 03	367925 03	371008 03	373507 03	375624 03	377473 03	379122 03	380615 03	381983 03
429.5	364272 03	366506 03	368388 03	371473 03	373973 03	376092 03	377942 03	379592 03	381086 03	382455 03
430.0	364732 03	366967 03	368851 03	371938 03	374440 03	376560 03	378411 03	380062 03	381557 03	382927 03
430.5	365192 03	367429 03	369314 03	372403 03	374906 03	377028 03	378881 03	380532 03	382028 03	383399 03
431.0	365653 03	367891 03	369777 03	372868 03	375373 03	377496 03	379350 03	381002 03	382499 03	383871 03
431.5	366113 03	368353 03	370246 03	373333 03	375839 03	377964 03	379819 03	381473 03	382970 03	384343 03
432.0	366574 03	368815 03	370703 03	373798 03	376306 03	378432 03	380288 03	381943 03	383441 03	384815 03
432.5	367034 03	369277 03	371166 03	374263 03	376773 03	378900 03	380757 03	382413 03	383913 03	385287 03
433.0	367494 03	369738 03	371629 03	374729 03	377239 03	379368 03	381226 03	382883 03	384384 03	385759 03
433.5	367955 03	370200 03	372093 03	375194 03	377706 03	379836 03	381696 03	383353 03	384855 03	386231 03
434.0	368415 03	370662 03	372556 03	375659 03	378173 03	380304 03	382165 03	383824 03	385326 03	386703 03
434.5	368876 03	371124 03	373019 03	376124 03	378640 03	380772 03	382634 03	384294 03	385797 03	387175 03
435.0	369336 03	371586 03	373482 03	376589 03	379106 03	381240 03	383103 03	384764 03	386269 03	387647 03
435.5	369797 03	372048 03	373945 03	377054 03	379573 03	381708 03	383573 03	385235 03	386740 03	388119 03
436.0	370258 03	372510 03	374409 03	377519 03	380040 03	382176 03	384042 03	385705 03	387211 03	388591 03
436.5	370718 03	372972 03	374872 03	377985 03	380507 03	382645 03	384511 03	386175 03	387682 03	389064 03
437.0	371179 03	373434 03	375335 03	378450 03	380974 03	383113 03	384980 03	386646 03	388154 03	389536 03

1.0	886105-02	.980000	.650000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
1.1	370691-22	.116893-19	.308698-16	.122571-13	.106313-11	.407579-10	.889504-09	.128525-07	.135531-06	.111478-05
1.2	683989-11	.121463-09	.700455-08	.124376-06	.115834-05	.717217-05	.335061-04	.127368-03	.413668-03	.110676-02
1.3	398820-07	.271457-06	.405176-05	.275787-04	.122044-03	.411706-03	.115090-02	.280520-02	.616847-02	.124696-01
1.4	309706-05	.130510-04	.991098-04	.417703-03	.122519-02	.317558-02	.687426-01	.134391-01	.243275-01	.414927-01
1.5	421137-04	.135801-03	.683594-03	.216177-02	.528435-02	.109826-01	.234234-01	.350448-01	.566175-01	.873476-01
1.6	248128-03	.674449-03	.250315-02	.654068-02	.137996-01	.254533-01	.428339-01	.674796-01	.184213-00	.446262-00
1.7	879154-03	.280804-02	.638316-02	.145652-01	.276898-01	.469482-01	.736460-01	.109267-00	.155572-00	.214739-00
1.8	228649-02	.469775-02	.129838-01	.267845-01	.471299-01	.750820-01	.111823-00	.158724-00	.217461-00	.298156-00
1.9	463847-02	.918331-02	.227162-01	.433564-01	.718865-01	.109174-00	.156246-00	.214367-00	.285143-00	.378657-00
1.0	886105-02	.157938-01	.357658-01	.641848-01	.101531-00	.148472-00	.205900-00	.274996-00	.357317-00	.454936-00
1.1	146120-01	.247335-01	.521523-01	.890340-01	.135576-00	.192278-00	.259933-00	.339667-00	.433019-00	.542873-00
1.2	222666-01	.361289-01	.717882-01	.117607-00	.173543-00	.239978-00	.317643-00	.407645-00	.511528-00	.631484-00
1.3	319331-01	.499825-01	.945238-01	.149589-00	.214992-00	.291046-00	.378464-00	.478359-00	.592302-00	.722448-00
1.4	436614-01	.662916-01	.120179-00	.184677-00	.259530-00	.345040-00	.441936-00	.551360-00	.674927-00	.814847-00
1.5	574575-01	.849818-01	.142561-00	.222586-00	.308815-00	.401589-00	.507684-00	.626292-00	.759084-00	.908334-00
1.6	732955-01	.105964-00	.174479-00	.263057-00	.356551-00	.460384-00	.575403-00	.702871-00	.844522-00	.100278-01
1.7	911275-01	.129137-00	.212752-00	.305858-00	.408480-00	.521161-00	.644843-00	.780867-00	.931845-00	.109779-01
1.8	118891-00	.154393-00	.248206-00	.350783-00	.462383-00	.583702-00	.715795-00	.860094-00	.101849-01	.119349-01
1.9	132515-00	.184624-00	.285683-00	.397647-00	.518066-00	.647818-00	.788084-00	.940398-00	.110674-01	.128968-01
2.0	155923-00	.218721-00	.325038-00	.446287-00	.573564-00	.713350-00	.861566-00	.102165-01	.119567-01	.138829-01
2.1	181039-00	.241562-00	.361137-00	.496559-00	.634132-00	.780160-00	.936115-00	.110375-01	.128522-01	.148327-01
2.2	207784-00	.274409-00	.408860-00	.548335-00	.694244-00	.848131-00	.101163-01	.118659-01	.137529-01	.158055-01
2.3	236804-00	.308210-00	.453096-00	.601500-00	.755568-00	.917160-00	.108801-01	.127012-01	.146584-01	.167818-01
2.4	265865-00	.343797-00	.492746-00	.659592-00	.818067-00	.987156-00	.116518-01	.135425-01	.155682-01	.177527-01
2.5	297058-00	.388789-00	.545718-00	.711599-00	.845195-00	.105804-01	.124384-01	.143894-01	.164817-01	.187325-01
2.6	329596-00	.439112-00	.593931-00	.768361-00	.946053-00	.112975-01	.132164-01	.152413-01	.173986-01	.197288-01
2.7	363416-00	.458695-00	.643308-00	.826163-00	.101149-01	.120222-01	.140082-01	.160979-01	.183186-01	.207838-01
2.8	398459-00	.498473-00	.693782-00	.884938-00	.107774-01	.127539-01	.148056-01	.169587-01	.192415-01	.216878-01
2.9	434669-00	.543385-00	.745289-00	.944626-00	.114477-01	.134921-01	.156682-01	.178234-01	.201669-01	.226738-01
3.0	471993-00	.584374-00	.797771-00	.100517-01	.121253-01	.142365-01	.164458-01	.186917-01	.210947-01	.236597-01
3.1	510381-00	.628389-00	.851177-00	.106653-01	.128899-01	.149867-01	.172278-01	.195634-01	.228246-01	.246474-01
3.2	549786-00	.673381-00	.905458-00	.112865-01	.135810-01	.157422-01	.180442-01	.204382-01	.229566-01	.256359-01
3.3	590166-00	.719334-00	.960569-00	.119149-01	.141982-01	.165027-01	.188645-01	.213159-01	.238904-01	.266252-01
3.4	631479-00	.766317-00	.101647-01	.125502-01	.149013-01	.172681-01	.196886-01	.221964-01	.248259-01	.276152-01
3.5	673686-00	.813778-00	.107312-01	.131920-01	.156898-01	.180379-01	.205162-01	.230795-01	.257638-01	.286859-01
3.6	716751-00	.862253-00	.113048-01	.138399-01	.163235-01	.188121-01	.213471-01	.239650-01	.267017-01	.295971-01
3.7	760640-00	.911506-00	.118853-01	.144937-01	.170422-01	.195902-01	.221812-01	.248527-01	.276417-01	.305889-01
3.8	805320-00	.961505-00	.124723-01	.151531-01	.177656-01	.203722-01	.230183-01	.257426-01	.285831-01	.315811-01
3.9	850762-00	.101222-01	.130656-01	.154179-01	.184934-01	.211579-01	.238983-01	.266346-01	.295257-01	.325738-01
4.0	896936-00	.106362-01	.136648-01	.164878-01	.192256-01	.219470-01	.247809-01	.275284-01	.304695-01	.335669-01
4.1	943816-00	.111569-01	.142697-01	.171625-01	.199618-01	.227394-01	.255461-01	.284241-01	.314443-01	.345684-01
4.2	991376-00	.116839-01	.148802-01	.178420-01	.207819-01	.235350-01	.263937-01	.293216-01	.323683-01	.355542-01
4.3	103959-01	.12170-01	.154959-01	.182259-01	.214458-01	.243337-01	.272437-01	.302207-01	.333827-01	.365484-01
4.4	108844-01	.127560-01	.161167-01	.192141-01	.221933-01	.251352-01	.280959-01	.311213-01	.342550-01	.375428-01
4.5	113790-01	.133007-01	.167424-01	.199065-01	.229442-01	.259395-01	.289820-01	.320235-01	.352038-01	.385375-01
4.6	118796-01	.138509-01	.173728-01	.206029-01	.236984-01	.267465-01	.298066-01	.329272-01	.361533-01	.395325-01
4.7	123858-01	.144864-01	.180077-01	.213031-01	.244559-01	.275560-01	.306150-01	.338222-01	.371837-01	.405277-01
4.8	128976-01	.149671-01	.186470-01	.220079-01	.252163-01	.283680-01	.315252-01	.347385-01	.380549-01	.415231-01
4.9	134144-01	.155327-01	.192905-01	.227144-01	.259798-01	.291824-01	.323873-01	.356462-01	.390068-01	.425188-01
5.0	139371-01	.161031-01	.199382-01	.234253-01	.267460-01	.299991-01	.332511-01	.365550-01	.399594-01	.435146-01

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
5.1	146645 01	166781 01	205897 01	241396 01	275151 01	308179 01	341166 01	374650 01	409127 01	445106 01
5.2	149968 01	172577 01	212451 01	248570 01	282867 01	316389 01	349837 01	383762 01	418667 01	455068 01
5.3	155338 01	178416 01	219043 01	255776 01	290610 01	324620 01	358523 01	392884 01	428212 01	465831 01
5.4	160754 01	184298 01	225669 01	263012 01	298377 01	332870 01	367225 01	402017 01	437764 01	474996 01
5.5	166215 01	190221 01	232331 01	270277 01	306168 01	341140 01	375942 01	411160 01	447321 01	484962 01
5.6	171719 01	196184 01	239027 01	277570 01	313983 01	349428 01	384672 01	420313 01	456884 01	494938 01
5.7	177266 01	202185 01	245755 01	284898 01	321820 01	357734 01	393417 01	429475 01	466453 01	504899 01
5.8	182854 01	208225 01	252515 01	292230 01	329679 01	366058 01	402174 01	438646 01	476026 01	514869 01
5.9	188482 01	214301 01	259306 01	299611 01	337559 01	374398 01	410944 01	447827 01	485604 01	524840 01
6.0	194149 01	220413 01	266127 01	307009 01	345460 01	382755 01	419727 01	457015 01	495188 01	534812 01
6.1	199854 01	226560 01	272978 01	314431 01	353381 01	391120 01	428522 01	466213 01	504776 01	544785 01
6.2	205597 01	232741 01	279857 01	321878 01	361321 01	399516 01	437328 01	475418 01	514368 01	554759 01
6.3	211375 01	238954 01	286763 01	329347 01	369280 01	407920 01	446146 01	484631 01	523965 01	564734 01
6.4	217189 01	245200 01	293697 01	336839 01	377258 01	416338 01	454975 01	493851 01	533565 01	574710 01
6.5	223037 01	251478 01	300657 01	344353 01	385254 01	424770 01	463815 01	503080 01	543170 01	584687 01
6.6	228916 01	257786 01	307642 01	351888 01	393267 01	433216 01	472665 01	512315 01	552779 01	594664 01
6.7	234833 01	264124 01	314653 01	359444 01	401297 01	441676 01	481525 01	521557 01	562392 01	604643 01
6.8	240779 01	270491 01	321688 01	367021 01	409344 01	450149 01	490395 01	530806 01	572009 01	614621 01
6.9	246757 01	276887 01	328746 01	374617 01	417407 01	458635 01	499275 01	540061 01	581629 01	624601 01
7.0	252766 01	283311 01	335828 01	382232 01	425485 01	467133 01	508165 01	549323 01	591252 01	634581 01
7.1	258804 01	289762 01	342933 01	389867 01	433579 01	475643 01	517063 01	558592 01	600879 01	644562 01
7.2	264872 01	296239 01	350060 01	397519 01	441688 01	484166 01	525971 01	567866 01	610510 01	654543 01
7.3	270968 01	302743 01	357289 01	405190 01	449812 01	492700 01	534887 01	577147 01	620143 01	664525 01
7.4	277093 01	309272 01	364379 01	412870 01	457951 01	501245 01	543812 01	586433 01	629780 01	674508 01
7.5	283245 01	315826 01	371570 01	420584 01	466103 01	509802 01	552745 01	595725 01	639420 01	684491 01
7.6	289424 01	322425 01	378781 01	428306 01	474269 01	518369 01	561606 01	605022 01	649063 01	694474 01
7.7	295629 01	329007 01	386012 01	436045 01	482448 01	526947 01	570635 01	614325 01	658709 01	704458 01
7.8	301860 01	335633 01	393262 01	443800 01	490641 01	535535 01	579592 01	623633 01	668357 01	714442 01
7.9	308116 01	342282 01	400532 01	451571 01	498846 01	544134 01	588557 01	632946 01	678009 01	724427 01
8.0	314397 01	348954 01	407820 01	459357 01	507064 01	552742 01	597529 01	642265 01	687663 01	734412 01
8.1	320703 01	355647 01	415126 01	467159 01	515294 01	561360 01	606508 01	651508 01	697320 01	744398 01
8.2	327032 01	362363 01	422451 01	474975 01	523537 01	569980 01	615495 01	660916 01	706979 01	754384 01
8.3	333385 01	369099 01	429793 01	482806 01	531791 01	578625 01	624488 01	670249 01	716641 01	764370 01
8.4	339761 01	375956 01	437152 01	490651 01	540057 01	587271 01	633489 01	679586 01	726316 01	774357 01
8.5	346159 01	382834 01	444528 01	498510 01	548334 01	595926 01	642496 01	688928 01	735973 01	784344 01
8.6	352579 01	389732 01	451921 01	506382 01	556622 01	604590 01	651509 01	698275 01	745642 01	794331 01
8.7	359022 01	396649 01	459330 01	514269 01	564921 01	613263 01	660529 01	707626 01	755313 01	804319 01
8.8	365485 01	403586 01	466755 01	522168 01	573231 01	621944 01	669556 01	716981 01	764987 01	814307 01
8.9	371970 01	409942 01	474196 01	530080 01	581552 01	630633 01	678588 01	726340 01	774663 01	824295 01
9.0	378475 01	416816 01	481652 01	538005 01	589883 01	639331 01	687827 01	735703 01	784342 01	834283 01
9.1	385000 01	423709 01	489124 01	545943 01	598224 01	648036 01	696671 01	745071 01	794022 01	844272 01
9.2	391546 01	430619 01	496610 01	553893 01	606574 01	656749 01	705722 01	754442 01	803705 01	854261 01
9.3	398111 01	437548 01	504111 01	561854 01	614935 01	665470 01	714778 01	763818 01	813389 01	864250 01
9.4	404695 01	444494 01	511626 01	569828 01	623305 01	674199 01	723840 01	773197 01	823076 01	874240 01
9.5	411298 01	451456 01	519155 01	577813 01	631685 01	682935 01	732907 01	782579 01	832784 01	884230 01
9.6	417920 01	458436 01	526699 01	585810 01	640374 01	691678 01	741980 01	791966 01	842455 01	894220 01
9.7	424560 01	465433 01	534256 01	593818 01	649074 01	700429 01	751058 01	801356 01	852147 01	904210 01
9.8	431218 01	472445 01	541826 01	601837 01	657872 01	709186 01	760142 01	810750 01	861841 01	914200 01
9.9	437894 01	479474 01	549409 01	609867 01	666680 01	717951 01	769231 01	820147 01	871537 01	924191 01
10.0	444587 01	486518 01	557006 01	617938 01	675720 01	726722 01	778324 01	829557 01	881235 01	934182 01

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

ν/Q	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
10.1	.451298 01	.493578 01	.564615 01	.625959 01	.682153 01	.735500 01	.787423 01	.839511 01	.890935 01	.944173 01
10.2	.458025 01	.503653 01	.572237 01	.634021 01	.690595 01	.744284 01	.796527 01	.848358 01	.900361 01	.954164 01
10.3	.464769 01	.507744 01	.573872 01	.634202 01	.690445 01	.753076 01	.805635 01	.857769 01	.910339 01	.964155 01
10.4	.471530 01	.511849 01	.575174 01	.634501 01	.690501 01	.746174 01	.801480 01	.856182 01	.910944 01	.964147 01
10.5	.478307 01	.513668 01	.575177 01	.634266 01	.690569 01	.746777 01	.801866 01	.856599 01	.910950 01	.964139 01
10.6	.485099 01	.521303 01	.580267 01	.636367 01	.692442 01	.749487 01	.803989 01	.858191 01	.912431 01	.964131 01
10.7	.491908 01	.528251 01	.584778 01	.638529 01	.694478 01	.752924 01	.807116 01	.861442 01	.915168 01	.964122 01
10.8	.498732 01	.534431 01	.588223 01	.640599 01	.696413 01	.754813 01	.808248 01	.862480 01	.916879 01	.964111 01
10.9	.505571 01	.540589 01	.592927 01	.642599 01	.698248 01	.756593 01	.810364 01	.864329 01	.918592 01	.964101 01
11.0	.512425 01	.546778 01	.598663 01	.644541 01	.699980 01	.758342 01	.812122 01	.866122 01	.919900 01	.964089 01
11.1	.519294 01	.552981 01	.604370 01	.646428 01	.701705 01	.760926 01	.814668 01	.868622 01	.921163 01	.964077 01
11.2	.526178 01	.559197 01	.610100 01	.648248 01	.703445 01	.764722 01	.818417 01	.872601 01	.923739 01	.964065 01
11.3	.533076 01	.565427 01	.615857 01	.650000 01	.705178 01	.766472 01	.820178 01	.874801 01	.926339 01	.964053 01
11.4	.539989 01	.571668 01	.621616 01	.651668 01	.706905 01	.768178 01	.821801 01	.876401 01	.928901 01	.964041 01
11.5	.546915 01	.577923 01	.627385 01	.653333 01	.708628 01	.770000 01	.823601 01	.878201 01	.931501 01	.964029 01
11.6	.553855 01	.584190 01	.633100 01	.655000 01	.710345 01	.771878 01	.825401 01	.880001 01	.934101 01	.964017 01
11.7	.560809 01	.590469 01	.638866 01	.656668 01	.712058 01	.773800 01	.827301 01	.882001 01	.936701 01	.964005 01
11.8	.567777 01	.596761 01	.644633 01	.658333 01	.713766 01	.775800 01	.829301 01	.884001 01	.939301 01	.963993 01
11.9	.574758 01	.603864 01	.650400 01	.660000 01	.715478 01	.777800 01	.831301 01	.886001 01	.941901 01	.963981 01
12.0	.581751 01	.610300 01	.656133 01	.661668 01	.717190 01	.780000 01	.833801 01	.888001 01	.944501 01	.963969 01
12.1	.588750 01	.616707 01	.661866 01	.663333 01	.718902 01	.782000 01	.835301 01	.890001 01	.947101 01	.963957 01
12.2	.595778 01	.623145 01	.667600 01	.664889 01	.720614 01	.783800 01	.836801 01	.892001 01	.949701 01	.963945 01
12.3	.602810 01	.629483 01	.673333 01	.666445 01	.722326 01	.785600 01	.838301 01	.894001 01	.952301 01	.963933 01
12.4	.609855 01	.635821 01	.679066 01	.668000 01	.724038 01	.787400 01	.839801 01	.896001 01	.954901 01	.963921 01
12.5	.616912 01	.642159 01	.684800 01	.669556 01	.725750 01	.789200 01	.841301 01	.898001 01	.957501 01	.963909 01
12.6	.623981 01	.648500 01	.690533 01	.671111 01	.727462 01	.791000 01	.842801 01	.900001 01	.960101 01	.963897 01
12.7	.631063 01	.654838 01	.696266 01	.672668 01	.729174 01	.792800 01	.844301 01	.902601 01	.962701 01	.963885 01
12.8	.638156 01	.661176 01	.702000 01	.674222 01	.730886 01	.794600 01	.845801 01	.905201 01	.965301 01	.963873 01
12.9	.645261 01	.667514 01	.707833 01	.675778 01	.732598 01	.796400 01	.847301 01	.907801 01	.967901 01	.963861 01
13.0	.652377 01	.673852 01	.713666 01	.677333 01	.734310 01	.798200 01	.848801 01	.910401 01	.970501 01	.963849 01
13.2	.666645 01	.719032 01	.805928 01	.800003 01	.947189 01	.101045 02	.107159 02	.113108 02	.119236 02	.125397 02
13.4	.683957 01	.733955 01	.821806 01	.816445 01	.964453 01	.102835 02	.109084 02	.115086 02	.121185 02	.127396 02
13.6	.695333 01	.748916 01	.837716 01	.833316 01	.981819 01	.104627 02	.110951 02	.116985 02	.123134 02	.129395 02
13.8	.707711 01	.763916 01	.853658 01	.85012 01	.999165 01	.106420 02	.112899 02	.118885 02	.125044 02	.131396 02
14.0	.724151 01	.778953 01	.865630 01	.86300 01	.101653 02	.108215 02	.114848 02	.120785 02	.126944 02	.133393 02
14.2	.738633 01	.794628 01	.885632 01	.88378 01	.103392 02	.110111 02	.116898 02	.122686 02	.128944 02	.135392 02
14.4	.753154 01	.809138 01	.901663 01	.900248 01	.105132 02	.111809 02	.118649 02	.124588 02	.130935 02	.137391 02
14.6	.767714 01	.824263 01	.917724 01	.91704 01	.106875 02	.113609 02	.120501 02	.126490 02	.132887 02	.139390 02
14.8	.782333 01	.839462 01	.933812 01	.93386 02	.108619 02	.115409 02	.122354 02	.128394 02	.134830 02	.141389 02
15.0	.796949 01	.854676 01	.949928 01	.94970 02	.110365 02	.117212 02	.123809 02	.130297 02	.136790 02	.143389 02
15.2	.811622 01	.869922 01	.966071 01	.96675 02	.112113 02	.119015 02	.125664 02	.132282 02	.138742 02	.145388 02
15.4	.826331 01	.885200 01	.982241 01	.98244 02	.113863 02	.120820 02	.127521 02	.134187 02	.140695 02	.147387 02
15.6	.841075 01	.900511 01	.998436 01	.99834 02	.115614 02	.122627 02	.129378 02	.136013 02	.142548 02	.149386 02
15.8	.855854 01	.915852 01	.101466 02	.101927 02	.117367 02	.124435 02	.131237 02	.137920 02	.144681 02	.151386 02
16.0	.870667 01	.931224 01	.103090 02	.103122 02	.119122 02	.126243 02	.133096 02	.139827 02	.146555 02	.153305 02
16.2	.885513 01	.946625 01	.104717 02	.104721 02	.120879 02	.128054 02	.134958 02	.141735 02	.148589 02	.155388 02
16.4	.900392 01	.962056 01	.106347 02	.106346 02	.122636 02	.129865 02	.136818 02	.143644 02	.150543 02	.157386 02
16.6	.915302 01	.977516 01	.107978 02	.107978 02	.124396 02	.131678 02	.138680 02	.145553 02	.152518 02	.159388 02
16.8	.930244 01	.993053 01	.109612 02	.109612 02	.126157 02	.133492 02	.140543 02	.147462 02	.154373 02	.161382 02
17.0	.945217 01	.100852 02	.111249 02	.111249 02	.127919 02	.135307 02	.142407 02	.149373 02	.156328 02	.163382 02

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and P

$r \backslash Q$	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
17.20	.962221 01	.132406 02	.112807 02	.121729 02	.129683 02	.137123 02	.142771 02	.151284 02	.152023 02	.165301 02
17.40	.975254 01	.133963 02	.114520 02	.123436 02	.131449 02	.138940 02	.146137 02	.153195 02	.152039 02	.167191 02
17.60	.990316 01	.135523 02	.116171 02	.125146 02	.133215 02	.140759 02	.148003 02	.155107 02	.162195 02	.169300 02
17.80	.100541 02	.137085 02	.117816 02	.126857 02	.134983 02	.142578 02	.149870 02	.157019 02	.164151 02	.171388 02
18.00	.102053 02	.138649 02	.119463 02	.128570 02	.136753 02	.144399 02	.151738 02	.158932 02	.166100 02	.173379 02
18.20	.103567 02	.140216 02	.121112 02	.130284 02	.138524 02	.146220 02	.153607 02	.160862 02	.168065 02	.175379 02
18.40	.105085 02	.141786 02	.122733 02	.132000 02	.140296 02	.148043 02	.155476 02	.162768 02	.170022 02	.177378 02
18.60	.106605 02	.143358 02	.124416 02	.133718 02	.142069 02	.149866 02	.157346 02	.164674 02	.171979 02	.179377 02
18.80	.108128 02	.144932 02	.126070 02	.135437 02	.143844 02	.151691 02	.159217 02	.166589 02	.173937 02	.181377 02
19.00	.109653 02	.146509 02	.127727 02	.137158 02	.145620 02	.153517 02	.161089 02	.168504 02	.175894 02	.183377 02
19.20	.111181 02	.148088 02	.129386 02	.138880 02	.147397 02	.155343 02	.162961 02	.170420 02	.177852 02	.185376 02
19.40	.112711 02	.149669 02	.131046 02	.140604 02	.149176 02	.157171 02	.164834 02	.172337 02	.179811 02	.187376 02
19.60	.114244 02	.151253 02	.132709 02	.142329 02	.150955 02	.158999 02	.166708 02	.174253 02	.181769 02	.189375 02
19.80	.115780 02	.152838 02	.134373 02	.144056 02	.152736 02	.160828 02	.168583 02	.176171 02	.183728 02	.191375 02
20.00	.117317 02	.154426 02	.136039 02	.145784 02	.154518 02	.162659 02	.170458 02	.178008 02	.185607 02	.193374 02
20.20	.118857 02	.156016 02	.137706 02	.147514 02	.156301 02	.164490 02	.172333 02	.180006 02	.187646 02	.195374 02
20.40	.120400 02	.157608 02	.139375 02	.149245 02	.158085 02	.166322 02	.174210 02	.181925 02	.189605 02	.197373 02
20.60	.121945 02	.159202 02	.141046 02	.150977 02	.159870 02	.168154 02	.176087 02	.183864 02	.191565 02	.199373 02
20.80	.123492 02	.160798 02	.142719 02	.152711 02	.161656 02	.169988 02	.177964 02	.185763 02	.193525 02	.201373 02
21.00	.125041 02	.162396 02	.144393 02	.154446 02	.163344 02	.171823 02	.179843 02	.187683 02	.195485 02	.203372 02
21.20	.126592 02	.163996 02	.146069 02	.156182 02	.165232 02	.173658 02	.181721 02	.189683 02	.197445 02	.205372 02
21.40	.128146 02	.165598 02	.147746 02	.157920 02	.167022 02	.175494 02	.183601 02	.191454 02	.199105 02	.207372 02
21.60	.129701 02	.167202 02	.149425 02	.159659 02	.168812 02	.177319 02	.185481 02	.193145 02	.200602 02	.209371 02
21.80	.131259 02	.168817 02	.151106 02	.161399 02	.170604 02	.179169 02	.187362 02	.194966 02	.202322 02	.211371 02
22.00	.132819 02	.170435 02	.152788 02	.163140 02	.172396 02	.181007 02	.189243 02	.197288 02	.205288 02	.213378 02
22.20	.134381 02	.172064 02	.154471 02	.164883 02	.174190 02	.182846 02	.191124 02	.199210 02	.207249 02	.215378 02
22.40	.135945 02	.173706 02	.156156 02	.166627 02	.175984 02	.184686 02	.193007 02	.201132 02	.209210 02	.217378 02
22.60	.137511 02	.175362 02	.157842 02	.168372 02	.177779 02	.186527 02	.194890 02	.203055 02	.211172 02	.219369 02
22.80	.139078 02	.177033 02	.159533 02	.170018 02	.179576 02	.188369 02	.196873 02	.204979 02	.213134 02	.221369 02
23.00	.140648 02	.178716 02	.161219 02	.171865 02	.181373 02	.190211 02	.198657 02	.206902 02	.215096 02	.223369 02
23.20	.142220 02	.180402 02	.162910 02	.173563 02	.183171 02	.192054 02	.200541 02	.208826 02	.217058 02	.225368 02
23.40	.143793 02	.182092 02	.164602 02	.175323 02	.184970 02	.193897 02	.202426 02	.210750 02	.218923 02	.227368 02
23.60	.145369 02	.183787 02	.166295 02	.177114 02	.186770 02	.195742 02	.204312 02	.212675 02	.220982 02	.229368 02
23.80	.146946 02	.185486 02	.167990 02	.178965 02	.188571 02	.197587 02	.206198 02	.214600 02	.222945 02	.231368 02
24.00	.148525 02	.187192 02	.169706 02	.180818 02	.190373 02	.199432 02	.208084 02	.216525 02	.224908 02	.233367 02
24.20	.150106 02	.188912 02	.171433 02	.182972 02	.192175 02	.201279 02	.209971 02	.218450 02	.226871 02	.235367 02
24.40	.151689 02	.190637 02	.173061 02	.184627 02	.193978 02	.203126 02	.211859 02	.220376 02	.228834 02	.237367 02
24.60	.153273 02	.192367 02	.174694 02	.186383 02	.195973 02	.205193 02	.213946 02	.222302 02	.230797 02	.239366 02
24.80	.154859 02	.194102 02	.176432 02	.188142 02	.197988 02	.207362 02	.216263 02	.224729 02	.233263 02	.241866 02
25.00	.156447 02	.195842 02	.178184 02	.189998 02	.199993 02	.209670 02	.218724 02	.226156 02	.234724 02	.243366 02
25.20	.158036 02	.197586 02	.180000 02	.191856 02	.201920 02	.211520 02	.220541 02	.228083 02	.236688 02	.245366 02
25.40	.159627 02	.199339 02	.181864 02	.193816 02	.203987 02	.213670 02	.223303 02	.230910 02	.239651 02	.248365 02
25.60	.161220 02	.201099 02	.183737 02	.195784 02	.206065 02	.215862 02	.225904 02	.233666 02	.242580 02	.251365 02
25.80	.162814 02	.202864 02	.185618 02	.197762 02	.208255 02	.218162 02	.228504 02	.236482 02	.245544 02	.254365 02
26.00	.164409 02	.204635 02	.187506 02	.199872 02	.210544 02	.220562 02	.231046 02	.239199 02	.248454 02	.257366 02
26.25	.166408 02	.207412 02	.190392 02	.202820 02	.213928 02	.224166 02	.235004 02	.243366 02	.252864 02	.261864 02
26.50	.168407 02	.210195 02	.193277 02	.205762 02	.217062 02	.227504 02	.238666 02	.247266 02	.257066 02	.266366 02
26.75	.170409 02	.212984 02	.196162 02	.208704 02	.220222 02	.230966 02	.242466 02	.251366 02	.261466 02	.270866 02
27.00	.172414 02	.215778 02	.199048 02	.211644 02	.223562 02	.234666 02	.246566 02	.255866 02	.266366 02	.275866 02
27.25	.174420 02	.218577 02	.201933 02	.214584 02	.226562 02	.238066 02	.250366 02	.260366 02	.271366 02	.280866 02

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
27.50	.176429 02	.185262 02	.199561 02	.211452 02	.222031 02	.231832 02	.241171 02	.250265 02	.259281 02	.268363 02
27.75	.178440 02	.187326 02	.201709 02	.213665 02	.224301 02	.234153 02	.243540 02	.252639 02	.261737 02	.270863 02
28.00	.180454 02	.189392 02	.203857 02	.215800 02	.226572 02	.236475 02	.245909 02	.255093 02	.264419 02	.273362 02
28.25	.182470 02	.191461 02	.205944 02	.217884 02	.228644 02	.238579 02	.248078 02	.257507 02	.266652 02	.275862 02
28.50	.184488 02	.193531 02	.208033 02	.220013 02	.230717 02	.240672 02	.250199 02	.259921 02	.269109 02	.278362 02
28.75	.186508 02	.195603 02	.210133 02	.222133 02	.232791 02	.242844 02	.252591 02	.262336 02	.271567 02	.280862 02
29.00	.188530 02	.197677 02	.212460 02	.224451 02	.235066 02	.245170 02	.255019 02	.264751 02	.274025 02	.283361 02
29.25	.190554 02	.199753 02	.214625 02	.226671 02	.237242 02	.247396 02	.257382 02	.267167 02	.276483 02	.285861 02
29.50	.192580 02	.201831 02	.216783 02	.228893 02	.239429 02	.250022 02	.260135 02	.269953 02	.279941 02	.289361 02
29.75	.194609 02	.203911 02	.218942 02	.231147 02	.242497 02	.252750 02	.262508 02	.271999 02	.281399 02	.290861 02
30.00	.196639 02	.205992 02	.221103 02	.233641 02	.244776 02	.255078 02	.264881 02	.274416 02	.283858 02	.293360 02
30.25	.198671 02	.208076 02	.223266 02	.235867 02	.246756 02	.257406 02	.267256 02	.276833 02	.286317 02	.295860 02
30.50	.200706 02	.210161 02	.225430 02	.238094 02	.249337 02	.259736 02	.269630 02	.279251 02	.288776 02	.298368 02
30.75	.202742 02	.212247 02	.227595 02	.240321 02	.251619 02	.262066 02	.272005 02	.281669 02	.291235 02	.300860 02
31.00	.204780 02	.214336 02	.229762 02	.242551 02	.253901 02	.264397 02	.274381 02	.284047 02	.293694 02	.303359 02
31.25	.206820 02	.216426 02	.231930 02	.244781 02	.256169 02	.266729 02	.276757 02	.286505 02	.296154 02	.305859 02
31.50	.208862 02	.218518 02	.234099 02	.247402 02	.258865 02	.269661 02	.279334 02	.288924 02	.298463 02	.308359 02
31.75	.210906 02	.220611 02	.236270 02	.249244 02	.260755 02	.271394 02	.281511 02	.291393 02	.301073 02	.310859 02
32.00	.212951 02	.222706 02	.238442 02	.251478 02	.263041 02	.273728 02	.283809 02	.293763 02	.303533 02	.313359 02
32.25	.214999 02	.224803 02	.240615 02	.253712 02	.265328 02	.276062 02	.286267 02	.296183 02	.305993 02	.315858 02
32.50	.217048 02	.226901 02	.242790 02	.255948 02	.267616 02	.278397 02	.288646 02	.298663 02	.308454 02	.318358 02
32.75	.219099 02	.229001 02	.244966 02	.258165 02	.269905 02	.280733 02	.291025 02	.301023 02	.310914 02	.320858 02
33.00	.221151 02	.231102 02	.247143 02	.260422 02	.272194 02	.283069 02	.293405 02	.303444 02	.313375 02	.323358 02
33.25	.223206 02	.233205 02	.249321 02	.262661 02	.274485 02	.285406 02	.295785 02	.305865 02	.315835 02	.325858 02
33.50	.225262 02	.235309 02	.251501 02	.264900 02	.276776 02	.287744 02	.298165 02	.308287 02	.318296 02	.328357 02
33.75	.227319 02	.237415 02	.253682 02	.267141 02	.279062 02	.290082 02	.300546 02	.310788 02	.320757 02	.330857 02
34.00	.229379 02	.239523 02	.255864 02	.269381 02	.281361 02	.292421 02	.302928 02	.313330 02	.323219 02	.333357 02
34.25	.231440 02	.241631 02	.258047 02	.271625 02	.283654 02	.294760 02	.305310 02	.315553 02	.325680 02	.335857 02
34.50	.233502 02	.243742 02	.260232 02	.273869 02	.285949 02	.297100 02	.307692 02	.317975 02	.328141 02	.338357 02
34.75	.235567 02	.245853 02	.262417 02	.276113 02	.288244 02	.299441 02	.310075 02	.320398 02	.330603 02	.340857 02
35.00	.237633 02	.247967 02	.264604 02	.278359 02	.290540 02	.301782 02	.312458 02	.322821 02	.333065 02	.343356 02
35.25	.239700 02	.250081 02	.266792 02	.280605 02	.292836 02	.304123 02	.314842 02	.325245 02	.335527 02	.345856 02
35.50	.241769 02	.252197 02	.268981 02	.282852 02	.295134 02	.306466 02	.317226 02	.327668 02	.337989 02	.348356 02
35.75	.243839 02	.254314 02	.271171 02	.285101 02	.297432 02	.308809 02	.319610 02	.330092 02	.340451 02	.350856 02
36.00	.245911 02	.256433 02	.273362 02	.287350 02	.299730 02	.311152 02	.321995 02	.332517 02	.342913 02	.353356 02
36.25	.247985 02	.258553 02	.275555 02	.289600 02	.302030 02	.313496 02	.324391 02	.334941 02	.345376 02	.355856 02
36.50	.250060 02	.260674 02	.277748 02	.291850 02	.304330 02	.315841 02	.326766 02	.337366 02	.347839 02	.358355 02
36.75	.252136 02	.262797 02	.279943 02	.294102 02	.306631 02	.318186 02	.329152 02	.339791 02	.350301 02	.360855 02
37.00	.254214 02	.264921 02	.282138 02	.296355 02	.308933 02	.320532 02	.331539 02	.342216 02	.352764 02	.363355 02
37.25	.256294 02	.267046 02	.284335 02	.298600 02	.311235 02	.322878 02	.333926 02	.344642 02	.355227 02	.365855 02
37.50	.258375 02	.269173 02	.286532 02	.300862 02	.313538 02	.325224 02	.336313 02	.347068 02	.357690 02	.368355 02
37.75	.260457 02	.271300 02	.288731 02	.303117 02	.315841 02	.327572 02	.338701 02	.349494 02	.360154 02	.370855 02
38.00	.262540 02	.273430 02	.290931 02	.305373 02	.318146 02	.329919 02	.341089 02	.351920 02	.362617 02	.373355 02
38.25	.264626 02	.275560 02	.293131 02	.307630 02	.320451 02	.332268 02	.343477 02	.354347 02	.365080 02	.375854 02
38.50	.266712 02	.277691 02	.295333 02	.309888 02	.322756 02	.334616 02	.345866 02	.356774 02	.367544 02	.378354 02
38.75	.268800 02	.279824 02	.297536 02	.312146 02	.325062 02	.336966 02	.348255 02	.359201 02	.370008 02	.380854 02
39.00	.270889 02	.281958 02	.299739 02	.314405 02	.327369 02	.339315 02	.350645 02	.361628 02	.372472 02	.383354 02
39.25	.272979 02	.284093 02	.301944 02	.316665 02	.329677 02	.341666 02	.353035 02	.364056 02	.374936 02	.385854 02
39.50	.275071 02	.286229 02	.304149 02	.318926 02	.331985 02	.344016 02	.355425 02	.366483 02	.377400 02	.388354 02
39.75	.277164 02	.288367 02	.306356 02	.321187 02	.334294 02	.346368 02	.357816 02	.368911 02	.379864 02	.390854 02

Percentage Points of the χ^2 - Distribution
Values of χ^2 in Terms of Q and ν

ν	0.925000	0.900000	0.850000	0.800000	0.750000	0.700000	0.650000	0.600000	0.550000	0.500000
87.5	692305 02	710324 02	730906 02	762170 02	782518 02	801099 02	818581 02	835403 02	851898 02	868342 02
88.0	696760 02	714838 02	743514 02	766651 02	787262 02	805901 02	823434 02	840307 02	856850 02	873342 02
88.5	701217 02	719355 02	748122 02	771533 02	792007 02	810782 02	828289 02	845211 02	861803 02	878342 02
89.0	705675 02	723872 02	752732 02	776216 02	796753 02	815505 02	833143 02	850116 02	866755 02	883342 02
89.5	710135 02	728391 02	757342 02	780900 02	801499 02	820308 02	837999 02	855020 02	871700 02	888342 02
90.0	714596 02	732911 02	761954 02	785584 02	806247 02	825111 02	842854 02	859925 02	876661 02	893342 02
90.5	719058 02	737432 02	766567 02	790270 02	810995 02	829915 02	847710 02	864831 02	881614 02	898342 02
91.0	723523 02	741955 02	771181 02	794956 02	815743 02	834719 02	852566 02	869736 02	886567 02	903342 02
91.5	727988 02	746479 02	775796 02	799844 02	820493 02	839525 02	857342 02	874642 02	891520 02	908342 02
92.0	732455 02	751005 02	780412 02	804332 02	825243 02	844330 02	862280 02	879548 02	896474 02	913342 02
92.5	736924 02	755532 02	785029 02	809021 02	829993 02	849136 02	867138 02	884454 02	901427 02	918342 02
93.0	741394 02	760060 02	789647 02	813711 02	834745 02	853943 02	871996 02	889361 02	906381 02	923342 02
93.5	745865 02	764589 02	794266 02	818401 02	839497 02	858750 02	876854 02	894268 02	911335 02	928342 02
94.0	750338 02	769119 02	798887 02	823093 02	844249 02	863558 02	881713 02	899175 02	916288 02	933342 02
94.5	754812 02	773651 02	803508 02	827785 02	849003 02	868366 02	886572 02	904082 02	921242 02	938342 02
95.0	759288 02	778184 02	808130 02	832478 02	853757 02	873175 02	891431 02	908990 02	926197 02	943342 02
95.5	763765 02	782719 02	812753 02	837172 02	858512 02	877984 02	896291 02	913897 02	931151 02	948342 02
96.0	768244 02	787254 02	817378 02	841867 02	863267 02	882794 02	901151 02	918606 02	936105 02	953342 02
96.5	772723 02	791791 02	822003 02	846562 02	868023 02	887604 02	906012 02	923714 02	941060 02	958342 02
97.0	777208 02	796329 02	826629 02	851259 02	872779 02	892415 02	910873 02	928622 02	946014 02	963342 02
97.5	781687 02	800868 02	831256 02	855956 02	877537 02	897226 02	915734 02	933531 02	950969 02	968341 02
98.0	786171 02	805408 02	835804 02	860654 02	882295 02	902038 02	920596 02	938440 02	955924 02	973341 02
98.5	790656 02	809950 02	840513 02	865353 02	887053 02	906850 02	925458 02	943349 02	960879 02	978341 02
99.0	795142 02	814493 02	845143 02	870052 02	891812 02	911663 02	930320 02	948259 02	965834 02	983341 02
99.5	799630 02	819036 02	849774 02	874752 02	896572 02	916476 02	935183 02	953169 02	970789 02	988341 02
100.0	804119 02	823581 02	854406 02	879453 02	901332 02	921289 02	940046 02	958078 02	975744 02	993341 02
100.5	808610 02	828127 02	859039 02	884155 02	906093 02	926104 02	944909 02	962989 02	980700 02	998341 02
101.0	813101 02	832675 02	863673 02	888858 02	910895 02	930918 02	949773 02	967899 02	985655 02	100334 03
101.5	817594 02	837223 02	868357 02	893561 02	915617 02	935733 02	954637 02	972810 02	990611 02	100834 03
102.0	822088 02	841773 02	872943 02	898265 02	920380 02	940549 02	959501 02	977720 02	995567 02	101334 03
102.5	826583 02	846323 02	877579 02	902970 02	925143 02	945365 02	964366 02	982631 02	100052 03	101834 03
103.0	831080 02	850875 02	882217 02	907675 02	929907 02	950181 02	969231 02	987543 02	100548 03	102334 03
103.5	835578 02	855428 02	886855 02	912381 02	934671 02	954998 02	974096 02	992454 02	101043 03	102834 03
104.0	840077 02	859982 02	891494 02	917088 02	939436 02	959815 02	978962 02	997366 02	101539 03	103334 03
104.5	844577 02	864537 02	896134 02	921796 02	944202 02	964633 02	983828 02	100228 03	102035 03	103834 03
105.0	849079 02	869093 02	900775 02	926504 02	948968 02	969451 02	988695 02	100719 03	102530 03	104334 03
105.5	853581 02	873650 02	905416 02	931213 02	953735 02	974270 02	993561 02	101210 03	103026 03	104834 03
106.0	858085 02	878208 02	910059 02	935922 02	958502 02	979089 02	998428 02	101701 03	103522 03	105334 03
106.5	862590 02	882767 02	914702 02	940633 02	963276 02	983908 02	100330 03	102193 03	104017 03	105834 03
107.0	867096 02	887327 02	919347 02	945344 02	968030 02	988728 02	100816 03	102684 03	104513 03	106334 03
107.5	871604 02	891889 02	923992 02	950056 02	972807 02	993548 02	101303 03	103175 03	105009 03	106834 03
108.0	876112 02	896451 02	928637 02	954768 02	977577 02	998369 02	101790 03	103667 03	105504 03	107334 03
108.5	880622 02	901014 02	933284 02	959481 02	982347 02	100319 03	102277 03	104158 03	106008 03	107834 03
109.0	885132 02	905579 02	937932 02	964195 02	987117 02	100801 03	102764 03	104649 03	106496 03	108334 03
109.5	889644 02	910144 02	942580 02	968909 02	991888 02	101283 03	103251 03	105141 03	106992 03	108834 03
110.0	894157 02	914710 02	947229 02	973624 02	996660 02	101766 03	103738 03	105632 03	107487 03	109334 03
110.5	898671 02	919278 02	951879 02	978340 02	100143 03	102248 03	104225 03	106124 03	107983 03	109834 03
111.0	903187 02	923846 02	956530 02	983056 02	100628 03	102748 03	104712 03	106615 03	108479 03	110334 03
111.5	907703 02	928415 02	961182 02	987773 02	101098 03	103243 03	105199 03	107107 03	108975 03	110834 03
112.0	912220 02	932946 02	965834 02	992491 02	101575 03	103739 03	105686 03	107598 03	109476 03	111334 03

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

ν/Q	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
112.5	.916739 02	.937557 02	.970467 02	.997209 02	.102053 03	.104177 03	.106173 03	.108090 03	.109966 03	.111834 03
113.0	.921256 02	.942129 02	.975141 02	.100193 03	.102530 03	.104660 03	.106660 03	.108581 03	.110462 03	.112334 03
113.5	.925779 02	.946702 02	.979795 02	.100637 03	.103000 03	.105142 03	.107147 03	.109073 03	.110958 03	.112834 03
114.0	.930301 02	.951276 02	.984451 02	.101135 03	.103485 03	.105625 03	.107634 03	.109564 03	.111454 03	.113334 03
114.5	.934823 02	.955851 02	.989107 02	.101609 03	.103963 03	.106103 03	.108121 03	.110056 03	.111949 03	.113834 03
115.0	.939347 02	.960427 02	.993764 02	.102081 03	.104440 03	.106590 03	.108609 03	.110547 03	.112445 03	.114334 03
115.5	.943872 02	.965004 02	.998422 02	.102553 03	.104910 03	.107073 03	.109096 03	.111039 03	.112941 03	.114834 03
116.0	.948398 02	.969582 02	.100308 03	.103025 03	.105396 03	.107556 03	.109583 03	.111531 03	.113437 03	.115334 03
116.5	.952925 02	.974160 02	.100774 03	.103498 03	.105874 03	.108038 03	.110071 03	.112022 03	.113933 03	.115834 03
117.0	.957453 02	.978740 02	.101240 03	.103973 03	.106352 03	.108521 03	.110558 03	.112514 03	.114429 03	.116334 03
117.5	.961981 02	.983320 02	.101706 03	.104443 03	.106829 03	.109004 03	.111045 03	.113006 03	.114925 03	.116834 03
118.0	.966511 02	.987902 02	.102172 03	.104915 03	.107307 03	.109487 03	.111533 03	.113498 03	.115420 03	.117334 03
118.5	.971042 02	.992464 02	.102638 03	.105388 03	.107785 03	.109970 03	.112020 03	.113989 03	.115916 03	.117834 03
119.0	.975574 02	.997067 02	.103105 03	.105860 03	.108263 03	.110453 03	.112508 03	.114481 03	.116412 03	.118334 03
119.5	.980107 02	.100165 03	.103571 03	.106333 03	.108742 03	.110936 03	.112995 03	.114973 03	.116908 03	.118834 03
120.0	.984641 02	.100624 03	.104037 03	.106806 03	.109220 03	.111419 03	.113483 03	.115465 03	.117404 03	.119334 03
120.5	.989176 02	.101082 03	.104504 03	.107278 03	.109698 03	.111902 03	.113970 03	.115956 03	.117900 03	.119834 03
121.0	.993712 02	.101541 03	.104970 03	.107751 03	.110176 03	.112385 03	.114458 03	.116448 03	.118396 03	.120334 03
121.5	.998248 02	.102000 03	.105437 03	.108224 03	.110654 03	.112868 03	.114945 03	.116940 03	.118892 03	.120834 03
122.0	.100279 03	.102458 03	.105904 03	.108697 03	.111133 03	.113351 03	.115433 03	.117432 03	.119388 03	.121334 03
122.5	.100732 03	.102917 03	.106371 03	.109170 03	.111611 03	.113834 03	.115920 03	.117924 03	.119884 03	.121834 03
123.0	.101186 03	.103376 03	.106837 03	.109643 03	.112089 03	.114317 03	.116408 03	.118416 03	.120380 03	.122334 03
123.5	.101640 03	.103835 03	.107304 03	.110116 03	.112568 03	.114801 03	.116896 03	.118908 03	.120876 03	.122834 03
124.0	.102095 03	.104295 03	.107771 03	.110589 03	.113046 03	.115284 03	.117384 03	.119399 03	.121372 03	.123334 03
124.5	.102549 03	.104754 03	.108238 03	.111063 03	.113525 03	.115767 03	.117871 03	.119891 03	.121868 03	.123834 03
125.0	.103003 03	.105213 03	.108705 03	.111536 03	.114004 03	.116251 03	.118359 03	.120383 03	.122364 03	.124334 03
125.5	.103458 03	.105673 03	.109173 03	.112009 03	.114482 03	.116734 03	.118847 03	.120875 03	.122860 03	.124834 03
126.0	.103912 03	.106132 03	.109640 03	.112483 03	.114961 03	.117217 03	.119335 03	.121367 03	.123356 03	.125334 03
126.5	.104367 03	.106592 03	.110107 03	.112956 03	.115440 03	.117701 03	.119822 03	.121859 03	.123852 03	.125834 03
127.0	.104821 03	.107051 03	.110574 03	.113430 03	.115918 03	.118184 03	.120310 03	.122351 03	.124348 03	.126334 03
127.5	.105276 03	.107511 03	.111042 03	.113903 03	.116397 03	.118668 03	.120798 03	.122843 03	.124844 03	.126834 03
128.0	.105731 03	.107971 03	.111509 03	.114377 03	.116876 03	.119151 03	.121286 03	.123335 03	.125340 03	.127334 03
128.5	.106186 03	.108431 03	.111977 03	.114850 03	.117355 03	.119635 03	.121774 03	.123827 03	.125836 03	.127834 03
129.0	.106641 03	.108891 03	.112445 03	.115324 03	.117834 03	.120118 03	.122262 03	.124320 03	.126332 03	.128334 03
129.5	.107096 03	.109351 03	.112912 03	.115798 03	.118313 03	.120602 03	.122750 03	.124812 03	.126828 03	.128834 03
130.0	.107552 03	.109811 03	.113380 03	.116272 03	.118792 03	.121086 03	.123238 03	.125304 03	.127324 03	.129334 03
130.5	.108007 03	.110271 03	.113848 03	.116746 03	.119271 03	.121570 03	.123726 03	.125796 03	.127820 03	.129834 03
131.0	.108462 03	.110732 03	.114316 03	.117219 03	.119750 03	.122053 03	.124214 03	.126288 03	.128316 03	.130334 03
131.5	.108918 03	.111192 03	.114784 03	.117693 03	.120229 03	.122537 03	.124702 03	.126780 03	.128813 03	.130834 03
132.0	.109373 03	.111652 03	.115252 03	.118167 03	.120708 03	.123021 03	.125190 03	.127272 03	.129309 03	.131334 03
132.5	.109829 03	.112113 03	.115720 03	.118641 03	.121187 03	.123505 03	.125678 03	.127765 03	.129805 03	.131834 03
133.0	.110285 03	.112573 03	.116188 03	.119116 03	.121667 03	.123989 03	.126166 03	.128257 03	.130301 03	.132334 03
133.5	.110740 03	.113034 03	.116656 03	.119590 03	.122146 03	.124472 03	.126655 03	.128749 03	.130797 03	.132834 03
134.0	.111196 03	.113495 03	.117124 03	.120064 03	.122625 03	.124956 03	.127143 03	.129241 03	.131293 03	.133334 03
134.5	.111652 03	.113956 03	.117592 03	.120538 03	.123105 03	.125440 03	.127631 03	.129733 03	.131789 03	.133834 03
135.0	.112108 03	.114417 03	.118061 03	.121012 03	.123584 03	.125924 03	.128119 03	.130226 03	.132286 03	.134334 03
135.5	.112565 03	.114877 03	.118529 03	.121487 03	.124063 03	.126408 03	.128608 03	.130718 03	.132782 03	.134834 03
136.0	.113021 03	.115338 03	.118998 03	.121961 03	.124543 03	.126892 03	.129096 03	.131210 03	.133278 03	.135334 03
136.5	.113477 03	.115800 03	.119466 03	.122436 03	.125022 03	.127376 03	.129584 03	.131703 03	.133774 03	.135834 03
137.0	.113933 03	.116262 03	.119935 03	.122910 03	.125502 03	.127860 03	.130072 03	.132195 03	.134270 03	.136334 03

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
137.5	114390 03	116722 03	120404 03	123365 03	125982 03	128345 03	130561 03	132687 03	134766 03	136834 03
138.0	114847 03	117183 03	120872 03	123859 03	126461 03	128829 03	131049 03	133180 03	135263 03	137334 03
138.5	115313 03	117645 03	121341 03	124334 03	126941 03	129313 03	131537 03	133672 03	135759 03	137834 03
139.0	115760 03	118106 03	121810 03	124809 03	127421 03	129797 03	132026 03	134164 03	136255 03	138334 03
139.5	116217 03	118568 03	122279 03	125283 03	127900 03	130281 03	132514 03	134657 03	136751 03	138834 03
140.0	116674 03	119029 03	122748 03	125758 03	128380 03	130766 03	133003 03	135149 03	137248 03	139334 03
140.5	117130 03	119491 03	123217 03	126233 03	128860 03	131250 03	133491 03	135641 03	137744 03	139834 03
141.0	117588 03	119953 03	123686 03	126708 03	129340 03	131734 03	133980 03	136134 03	138240 03	140334 03
141.5	118045 03	120414 03	124155 03	127183 03	129820 03	132219 03	134468 03	136626 03	138736 03	140834 03
142.0	118502 03	120876 03	124624 03	127658 03	130299 03	132703 03	134957 03	137119 03	139233 03	141334 03
142.5	118959 03	121338 03	125093 03	128133 03	130779 03	133187 03	135445 03	137611 03	139729 03	141834 03
143.0	119416 03	121800 03	125562 03	128608 03	131259 03	133672 03	135934 03	138104 03	140225 03	142334 03
143.5	119874 03	122262 03	126032 03	129083 03	131739 03	134156 03	136422 03	138596 03	140721 03	142834 03
144.0	120331 03	122724 03	126501 03	129558 03	132219 03	134641 03	136911 03	139089 03	141218 03	143334 03
144.5	120789 03	123187 03	126970 03	130033 03	132700 03	135125 03	137400 03	139581 03	141714 03	143834 03
145.0	121246 03	123649 03	127440 03	130508 03	133180 03	135610 03	137888 03	140074 03	142210 03	144334 03
145.5	121704 03	124111 03	127909 03	130983 03	133660 03	136095 03	138377 03	140566 03	142707 03	144834 03
146.0	122162 03	124574 03	128379 03	131459 03	134140 03	136579 03	138866 03	141059 03	143203 03	145334 03
146.5	122620 03	125036 03	128849 03	131934 03	134620 03	137064 03	139354 03	141551 03	143699 03	145834 03
147.0	123078 03	125499 03	129318 03	132409 03	135101 03	137548 03	139843 03	142044 03	144195 03	146334 03
147.5	123536 03	125961 03	129788 03	132885 03	135581 03	138033 03	140332 03	142537 03	144692 03	146834 03
148.0	123994 03	126424 03	130258 03	133360 03	136061 03	138518 03	140821 03	143029 03	145188 03	147334 03
148.5	124452 03	126887 03	130728 03	133836 03	136542 03	139003 03	141309 03	143522 03	145684 03	147834 03
149.0	124910 03	127349 03	131198 03	134311 03	137022 03	139487 03	141798 03	144015 03	146181 03	148334 03
149.5	125368 03	127812 03	131667 03	134787 03	137502 03	139972 03	142287 03	144507 03	146677 03	148834 03
150.0	125827 03	128275 03	132137 03	135263 03	137983 03	140457 03	142776 03	145000 03	147174 03	149334 03
150.5	126285 03	128738 03	132608 03	135738 03	138463 03	140942 03	143265 03	145492 03	147670 03	149834 03
151.0	126743 03	129201 03	133078 03	136214 03	138944 03	141427 03	143754 03	145985 03	148166 03	150334 03
151.5	127202 03	129664 03	133548 03	136690 03	139424 03	141911 03	144242 03	146478 03	148663 03	150834 03
152.0	127661 03	130127 03	134018 03	137165 03	139905 03	142396 03	144731 03	146971 03	149159 03	151334 03
152.5	128119 03	130590 03	134488 03	137641 03	140386 03	142881 03	145220 03	147463 03	149655 03	151834 03
153.0	128578 03	131054 03	134958 03	138117 03	140866 03	143366 03	145709 03	147956 03	150152 03	152334 03
153.5	129037 03	131517 03	135429 03	138593 03	141347 03	143851 03	146198 03	148449 03	150648 03	152834 03
154.0	129496 03	131980 03	135899 03	139069 03	141828 03	144336 03	146687 03	148942 03	151145 03	153334 03
154.5	129955 03	132444 03	136370 03	139545 03	142308 03	144821 03	147176 03	149434 03	151641 03	153834 03
155.0	130414 03	132907 03	136840 03	140021 03	142789 03	145306 03	147665 03	149927 03	152137 03	154334 03
155.5	130873 03	133371 03	137311 03	140497 03	143270 03	145791 03	148154 03	150420 03	152634 03	154834 03
156.0	131332 03	133835 03	137781 03	140973 03	143751 03	146277 03	148643 03	150913 03	153130 03	155334 03
156.5	131791 03	134298 03	138252 03	141449 03	144232 03	146762 03	149132 03	151405 03	153627 03	155834 03
157.0	132250 03	134762 03	138722 03	141926 03	144713 03	147247 03	149621 03	151898 03	154123 03	156334 03
157.5	132710 03	135226 03	139193 03	142402 03	145194 03	147732 03	150111 03	152391 03	154620 03	156834 03
158.0	133169 03	135690 03	139664 03	142878 03	145675 03	148217 03	150600 03	152884 03	155116 03	157334 03
158.5	133629 03	136154 03	140135 03	143354 03	146156 03	148702 03	151089 03	153377 03	155613 03	157834 03
159.0	134088 03	136618 03	140606 03	143831 03	146637 03	149188 03	151578 03	153870 03	156109 03	158334 03
159.5	134548 03	137082 03	141077 03	144307 03	147118 03	149673 03	152067 03	154363 03	156605 03	158834 03
160.0	135007 03	137546 03	141547 03	144783 03	147599 03	150158 03	152556 03	154856 03	157102 03	159334 03
160.5	135467 03	138010 03	142018 03	145260 03	148080 03	150644 03	153046 03	155348 03	157598 03	159834 03
161.0	135927 03	138474 03	142490 03	145736 03	148561 03	151129 03	153535 03	155841 03	158095 03	160334 03
161.5	136387 03	138938 03	142961 03	146213 03	149042 03	151614 03	154024 03	156334 03	158591 03	160834 03
162.0	136847 03	139403 03	143432 03	146689 03	149523 03	152100 03	154513 03	156827 03	159088 03	161334 03

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
162.5	.137307 03	.139867 03	.142903 03	.147166 03	.150005 03	.152505 03	.155003 03	.157320 03	.159584 03	.161834 03
163.0	.137767 02	.140331 03	.143374 03	.147643 03	.150486 03	.153071 03	.155492 03	.157813 03	.160081 03	.162334 03
163.5	.138227 02	.140796 03	.143845 03	.148119 03	.150967 03	.153556 03	.155981 03	.158306 03	.160577 03	.162834 03
164.0	.138687 02	.141260 03	.144317 03	.148596 03	.151449 03	.154041 03	.156471 03	.158799 03	.161074 03	.163334 03
164.5	.139147 03	.141725 03	.144786 03	.149073 03	.151930 03	.154529 03	.156960 03	.159292 03	.161570 03	.163834 03
165.0	.139607 03	.142190 03	.145259 03	.149549 03	.152411 03	.155012 03	.157449 03	.159785 03	.162067 03	.164334 03
165.5	.140068 02	.142654 03	.145731 03	.150026 03	.152893 03	.155490 03	.157939 03	.160278 03	.162563 03	.164834 03
166.0	.140528 03	.143119 03	.146203 03	.150500 03	.153374 03	.155984 03	.158428 03	.160771 03	.163060 03	.165334 03
166.5	.140989 03	.143584 03	.146674 03	.151000 03	.153876 03	.156499 03	.158947 03	.161264 03	.163557 03	.165834 03
167.0	.141449 03	.144049 03	.147145 03	.151457 03	.154337 03	.156955 03	.159407 03	.161757 03	.164053 03	.166334 03
167.5	.141910 03	.144514 03	.147617 03	.151934 03	.154819 03	.157440 02	.159896 03	.162250 03	.164550 03	.166834 03
168.0	.142370 02	.144979 03	.148089 03	.152411 03	.155308 03	.157926 03	.160386 03	.162743 03	.165046 03	.167334 03
168.5	.142831 03	.145444 03	.148560 03	.152888 03	.155782 03	.158412 03	.160875 03	.163236 03	.165543 03	.167834 03
169.0	.143292 03	.145909 03	.149032 03	.153465 03	.156363 03	.158997 03	.161365 03	.163729 03	.166039 03	.168334 03
169.5	.143753 03	.146374 03	.149504 03	.153942 03	.156842 03	.159483 03	.161854 03	.164223 03	.166536 03	.168834 03
170.0	.144214 03	.146839 03	.150076 03	.154519 03	.157427 03	.159969 03	.162344 03	.164716 03	.167033 03	.169334 03
170.5	.144675 03	.147304 03	.150548 03	.154996 03	.157908 03	.160355 03	.162633 03	.165009 03	.167329 03	.169634 03
171.0	.145136 03	.147769 03	.151020 03	.155500 03	.158418 03	.160860 03	.163132 03	.165502 03	.167822 03	.170134 03
171.5	.145597 03	.148235 03	.151491 03	.156073 03	.158998 03	.161436 03	.163702 03	.166072 03	.168392 03	.170734 03
172.0	.146058 03	.148700 03	.152063 03	.156648 03	.159579 03	.162020 03	.164282 03	.166653 03	.168973 03	.171334 03
172.5	.146519 03	.149165 03	.152535 03	.157120 03	.160055 03	.162500 03	.164762 03	.167131 03	.169446 03	.171834 03
173.0	.146980 03	.149631 03	.153008 03	.157593 03	.160537 03	.163000 03	.165262 03	.167631 03	.169946 03	.172334 03
173.5	.147441 03	.150096 03	.153480 03	.158075 03	.161020 03	.163483 03	.165745 03	.168114 03	.170429 03	.172834 03
174.0	.147903 03	.150562 03	.153947 03	.158542 03	.161020 03	.163505 03	.165767 03	.168136 03	.170449 03	.172834 03
174.5	.148364 03	.151028 03	.154413 03	.159008 03	.161505 03	.163928 03	.166190 03	.168559 03	.170869 03	.173234 03
175.0	.148825 03	.151493 03	.154879 03	.159465 03	.161982 03	.164405 03	.166667 03	.169036 03	.171289 03	.173634 03
175.5	.149287 03	.151959 03	.155344 03	.160000 03	.162467 03	.164890 03	.167152 03	.169521 03	.171709 03	.174034 03
176.0	.149749 03	.152425 03	.155810 03	.160535 03	.163000 03	.165423 03	.167685 03	.170054 03	.172474 03	.174834 03
176.5	.150210 02	.152891 03	.156252 03	.160770 03	.163233 03	.165656 03	.167918 03	.170287 03	.172706 03	.175034 03
177.0	.150672 03	.153356 03	.156717 03	.161002 03	.163973 03	.166396 03	.168658 03	.171027 03	.173446 03	.175834 03
177.5	.151133 03	.153822 03	.157183 03	.161480 03	.164455 03	.166878 03	.169140 03	.171509 03	.173928 03	.176334 03
178.0	.151595 03	.154288 03	.157649 03	.162000 03	.164975 03	.167398 03	.169660 03	.172029 03	.174448 03	.176834 03
178.5	.152057 03	.154754 03	.158115 03	.162523 03	.165500 03	.167923 03	.170185 03	.172544 03	.174963 03	.177334 03
179.0	.152519 03	.155220 03	.158581 03	.163046 03	.166023 03	.168446 03	.170708 03	.173067 03	.175486 03	.177834 03
179.5	.152981 03	.155686 03	.159047 03	.163569 03	.166544 03	.168967 03	.171229 03	.173588 03	.176007 03	.178334 03
180.0	.153443 02	.156153 03	.159514 03	.164092 03	.167100 03	.169523 03	.171782 03	.174141 03	.176560 03	.178834 03
180.5	.153905 02	.156615 03	.160076 03	.164615 03	.167628 03	.170051 03	.172572 03	.174931 03	.177350 03	.179634 03
181.0	.154367 03	.157085 03	.160546 03	.165139 03	.168157 03	.170580 03	.173101 03	.175460 03	.177979 03	.180334 03
181.5	.154829 03	.157551 03	.161012 03	.165662 03	.168680 03	.171103 03	.173624 03	.176083 03	.178555 03	.180834 03
182.0	.155291 03	.158018 03	.161500 03	.166023 03	.169041 03	.171464 03	.174085 03	.176544 03	.179023 03	.181334 03
182.5	.155754 03	.158484 03	.161967 03	.166486 03	.169504 03	.171927 03	.174548 03	.177007 03	.179526 03	.181834 03
183.0	.156216 03	.158951 03	.162450 03	.166873 03	.169891 03	.172350 03	.175071 03	.177530 03	.180049 03	.182534 03
183.5	.156678 03	.159417 03	.162903 03	.167296 03	.170314 03	.172673 03	.175394 03	.177853 03	.180372 03	.182834 03
184.0	.157141 03	.159881 03	.163348 03	.167739 03	.170757 03	.173116 03	.175837 03	.178296 03	.180805 03	.183234 03
184.5	.157603 03	.160350 03	.163807 03	.168248 03	.171266 03	.173625 03	.176346 03	.178805 03	.181324 03	.183734 03
185.0	.158066 03	.160813 03	.164270 03	.168711 03	.171729 03	.174088 03	.176809 03	.179268 03	.181787 03	.184234 03
185.5	.158528 03	.161271 03	.164738 03	.169179 03	.172192 03	.174551 03	.177272 03	.179731 03	.182290 03	.184734 03
186.0	.158991 02	.161734 03	.165201 03	.169642 03	.172605 03	.174964 03	.177685 03	.180144 03	.182703 03	.185234 03
186.5	.159453 03	.162197 03	.165664 03	.170095 03	.173508 03	.175867 03	.178588 03	.181047 03	.183606 03	.186134 03
187.0	.159916 03	.162660 03	.166131 03	.170546 03	.173959 03	.176318 03	.179039 03	.181498 03	.184057 03	.186534 03

	.92500	.93000	.65000	.60000	.75000	.70050	.65000	.60000	.55000	.50000
187.5	.160379 02	.163150 03	.167514 03	.171038 03	.174101 03	.176802 03	.179486 03	.181981 03	.184416 03	.186834 03
188.0	.160842 03	.163617 03	.167980 03	.171517 03	.174583 03	.177369 03	.179976 03	.182474 03	.184913 03	.187334 03
188.5	.161304 03	.164084 03	.168461 03	.171995 03	.175066 03	.177855 03	.180466 03	.182967 03	.185403 03	.187834 03
189.0	.161767 03	.164551 03	.168934 03	.172477 03	.175549 03	.178342 03	.180956 03	.183461 03	.185966 03	.188334 03
189.5	.162230 03	.165018 03	.169407 03	.172951 03	.176031 03	.178828 03	.181446 03	.183954 03	.186403 03	.188834 03
190.0	.162693 03	.165485 03	.169881 03	.173430 03	.176514 03	.179315 03	.181936 03	.184448 03	.186900 03	.189334 03
190.5	.163156 03	.165952 03	.170354 03	.173908 03	.177047 03	.179801 03	.182427 03	.184941 03	.187396 03	.189834 03
191.0	.163619 03	.166419 03	.170828 03	.174387 03	.177579 03	.180288 03	.182917 03	.185435 03	.187893 03	.190334 03
191.5	.164083 03	.166887 03	.171301 03	.174865 03	.178074 03	.180774 03	.183407 03	.185928 03	.188390 03	.190834 03
192.0	.164546 03	.167354 03	.171575 03	.175143 03	.178354 03	.181051 03	.183697 03	.186282 03	.188817 03	.191334 03
192.5	.165009 02	.167821 03	.172048 03	.175622 03	.178828 03	.181528 03	.184186 03	.186815 03	.189384 03	.191834 03
193.0	.165472 03	.168288 03	.172522 03	.176101 03	.179283 03	.181968 03	.184617 03	.187220 03	.189780 03	.192334 03
193.5	.165936 03	.168756 03	.173003 03	.176587 03	.179779 03	.182462 03	.185111 03	.187720 03	.190280 03	.192834 03
194.0	.166399 03	.169223 03	.173479 03	.177067 03	.180260 03	.182942 03	.185591 03	.188200 03	.190770 03	.193334 03
194.5	.166862 03	.169691 03	.173943 03	.177533 03	.180736 03	.183417 03	.186056 03	.188650 03	.191210 03	.193734 03
195.0	.167326 03	.170158 03	.174436 03	.178025 03	.181234 03	.183915 03	.186554 03	.189140 03	.191680 03	.194234 03
195.5	.167790 03	.170626 03	.174908 03	.178500 03	.181714 03	.184405 03	.187054 03	.189640 03	.192180 03	.194734 03
196.0	.168253 03	.171095 03	.175376 03	.178970 03	.182200 03	.184881 03	.187520 03	.190100 03	.192640 03	.195134 03
196.5	.168717 03	.171561 03	.175843 03	.179440 03	.182670 03	.185351 03	.187990 03	.190570 03	.193110 03	.195634 03
197.0	.169180 03	.172029 03	.176311 03	.180013 03	.183243 03	.185924 03	.188564 03	.191140 03	.193680 03	.196234 03
197.5	.169644 03	.172496 03	.176778 03	.180480 03	.183710 03	.186391 03	.189030 03	.191610 03	.194150 03	.196734 03
198.0	.170108 03	.172964 03	.177249 03	.180951 03	.184181 03	.186862 03	.189490 03	.192060 03	.194600 03	.197134 03
198.5	.170572 03	.173432 03	.177717 03	.181419 03	.184649 03	.187330 03	.189950 03	.192510 03	.195050 03	.197534 03
199.0	.171035 03	.173898 03	.178185 03	.181887 03	.185117 03	.187798 03	.190410 03	.192960 03	.195480 03	.197934 03
199.5	.171499 03	.174367 03	.178657 03	.182359 03	.185589 03	.188270 03	.190880 03	.193430 03	.195950 03	.198434 03
200.0	.171963 03	.174835 03	.179128 03	.182830 03	.186060 03	.188741 03	.191350 03	.193890 03	.196400 03	.198834 03
200.5	.172427 03	.175303 03	.179598 03	.183300 03	.186530 03	.189211 03	.191820 03	.194360 03	.196830 03	.199234 03
201.0	.172891 03	.175771 03	.180063 03	.183765 03	.186995 03	.189676 03	.192280 03	.194820 03	.197290 03	.199734 03
201.5	.173355 03	.176239 03	.180531 03	.184233 03	.187463 03	.190144 03	.192750 03	.195290 03	.197760 03	.200234 03
202.0	.173820 03	.176707 03	.181001 03	.184703 03	.187933 03	.190614 03	.193220 03	.195760 03	.198230 03	.200634 03
202.5	.174284 03	.177175 03	.181459 03	.185161 03	.188391 03	.191072 03	.193680 03	.196220 03	.198700 03	.201134 03
203.0	.174748 03	.177643 03	.181928 03	.185630 03	.188860 03	.191541 03	.194150 03	.196700 03	.199200 03	.201634 03
203.5	.175212 03	.178112 03	.182403 03	.186105 03	.189335 03	.192016 03	.194620 03	.197160 03	.199660 03	.202134 03
204.0	.175676 03	.178580 03	.182871 03	.186573 03	.189803 03	.192484 03	.195090 03	.197630 03	.200130 03	.202634 03
204.5	.176141 03	.179048 03	.183339 03	.187041 03	.190271 03	.192952 03	.195560 03	.198100 03	.200600 03	.203134 03
205.0	.176605 03	.179516 03	.183807 03	.187509 03	.190739 03	.193420 03	.196030 03	.198570 03	.201070 03	.203534 03
205.5	.177070 03	.179985 03	.184276 03	.187978 03	.191208 03	.193889 03	.196490 03	.199030 03	.201530 03	.204034 03
206.0	.177534 03	.180453 03	.184744 03	.188446 03	.191676 03	.194357 03	.196960 03	.199500 03	.202000 03	.204534 03
206.5	.177999 03	.180921 03	.185212 03	.188914 03	.192144 03	.194825 03	.197430 03	.200000 03	.202500 03	.205034 03
207.0	.178463 03	.181390 03	.185681 03	.189383 03	.192613 03	.195294 03	.197890 03	.200430 03	.202930 03	.205434 03
207.5	.178928 03	.181858 03	.186149 03	.189851 03	.193081 03	.195762 03	.198360 03	.200900 03	.203400 03	.205934 03
208.0	.179392 03	.182327 03	.186618 03	.190320 03	.193550 03	.196231 03	.198830 03	.201370 03	.203870 03	.206334 03
208.5	.179857 03	.182795 03	.187086 03	.190788 03	.194018 03	.196699 03	.199290 03	.201830 03	.204330 03	.206834 03
209.0	.180322 03	.183264 03	.187555 03	.191257 03	.194487 03	.197168 03	.199760 03	.202300 03	.204800 03	.207334 03
209.5	.180787 03	.183733 03	.188024 03	.191726 03	.194956 03	.197637 03	.200230 03	.202770 03	.205270 03	.207734 03
210.0	.181251 03	.184201 03	.188492 03	.192184 03	.195414 03	.198095 03	.200690 03	.203230 03	.205730 03	.208234 03
210.5	.181716 03	.184666 03	.188957 03	.192649 03	.195879 03	.198560 03	.201160 03	.203700 03	.206200 03	.208734 03
211.0	.182181 03	.185131 03	.189422 03	.193114 03	.196344 03	.199025 03	.201620 03	.204160 03	.206660 03	.209134 03
211.5	.182646 03	.185596 03	.189887 03	.193579 03	.196809 03	.199490 03	.202090 03	.204630 03	.207130 03	.209634 03
212.0	.183111 03	.186061 03	.190352 03	.194044 03	.197274 03	.200000 03	.202600 03	.205140 03	.207640 03	.210134 03

Percentage Points of the χ^2 -Distribution
 in Terms of Q -Points

χ^2	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
212.5	.13576 03	.106545 03	.191216 03	.194904 03	.190256 03	.203225 03	.204003 03	.206663 03	.209258 03	.211834 03
213.0	.184041 03	.107814 03	.191691 03	.195463 03	.190739 03	.201712 03	.204494 03	.207157 03	.209755 03	.212334 03
213.5	.184506 03	.107483 03	.192166 03	.195943 03	.192223 03	.202200 03	.204985 03	.207651 03	.210252 03	.212834 03
214.0	.184971 03	.107152 03	.192641 03	.196423 03	.192707 03	.202687 03	.205475 03	.208145 03	.210749 03	.213334 03
214.5	.185437 03	.106821 03	.193116 03	.196902 03	.193190 03	.203174 03	.205966 03	.208639 03	.211246 03	.213834 03
215.0	.185902 03	.106490 03	.193591 03	.197382 03	.193678 03	.203662 03	.206477 03	.209152 03	.211743 03	.214334 03
215.5	.186367 03	.106159 03	.194066 03	.197862 03	.194156 03	.204149 03	.206957 03	.209626 03	.212248 03	.214834 03
216.0	.186832 03	.105828 03	.194541 03	.198341 03	.194642 03	.204636 03	.207438 03	.210120 03	.212737 03	.215334 03
216.5	.187298 03	.105497 03	.195016 03	.198821 03	.195125 03	.205124 03	.207929 03	.210614 03	.213234 03	.215834 03
217.0	.187763 03	.105166 03	.195491 03	.199301 03	.195609 03	.205611 03	.208419 03	.211108 03	.213731 03	.216334 03
217.5	.188229 03	.104835 03	.195966 03	.199781 03	.196093 03	.206099 03	.208910 03	.211602 03	.214228 03	.216834 03
218.0	.188694 03	.104504 03	.196441 03	.200260 03	.196577 03	.206586 03	.209401 03	.212096 03	.214725 03	.217334 03
218.5	.189160 03	.104173 03	.196916 03	.200740 03	.197064 03	.207073 03	.209892 03	.212590 03	.215222 03	.217834 03
219.0	.189625 03	.103842 03	.197391 03	.201220 03	.197560 03	.207561 03	.210383 03	.213084 03	.215719 03	.218334 03
219.5	.190091 03	.103511 03	.197866 03	.201700 03	.198058 03	.208048 03	.210873 03	.213578 03	.216216 03	.218834 03
220.0	.190556 03	.103180 03	.198342 03	.202180 03	.198552 03	.208536 03	.211364 03	.214072 03	.216713 03	.219334 03
220.5	.191022 03	.102849 03	.198817 03	.202660 03	.199050 03	.209023 03	.211855 03	.214565 03	.217210 03	.219834 03
221.0	.191488 03	.102518 03	.199292 03	.203140 03	.199551 03	.209511 03	.212346 03	.215059 03	.217707 03	.220334 03
221.5	.191953 03	.102187 03	.199768 03	.203620 03	.200048 03	.209998 03	.212837 03	.215553 03	.218204 03	.220834 03
222.0	.192419 03	.101856 03	.200243 03	.204100 03	.200546 03	.210486 03	.213327 03	.216047 03	.218701 03	.221334 03
222.5	.192885 03	.101525 03	.200718 03	.204580 03	.201043 03	.210973 03	.213816 03	.216541 03	.219198 03	.221834 03
223.0	.193351 03	.101194 03	.201194 03	.205060 03	.201540 03	.211461 03	.214309 03	.217035 03	.219695 03	.222334 03
223.5	.193817 03	.100863 03	.201669 03	.205540 03	.202037 03	.211948 03	.214800 03	.217529 03	.220192 03	.222834 03
224.0	.194283 03	.100532 03	.202145 03	.206020 03	.202534 03	.212436 03	.215291 03	.218023 03	.220689 03	.223334 03
224.5	.194749 03	.100201 03	.202620 03	.206500 03	.203031 03	.212924 03	.215782 03	.218517 03	.221186 03	.223834 03
225.0	.195215 03	.099870 03	.203096 03	.206980 03	.203528 03	.213411 03	.216273 03	.219011 03	.221683 03	.224334 03
225.5	.195681 03	.099539 03	.203571 03	.207460 03	.204026 03	.213899 03	.216764 03	.219505 03	.222180 03	.224834 03
226.0	.196147 03	.099208 03	.204047 03	.207940 03	.204523 03	.214386 03	.217254 03	.219999 03	.222677 03	.225334 03
226.5	.196613 03	.098877 03	.204522 03	.208421 03	.205020 03	.214874 03	.217745 03	.220493 03	.223174 03	.225834 03
227.0	.197079 03	.098546 03	.204998 03	.208901 03	.205518 03	.215362 03	.218236 03	.220987 03	.223671 03	.226334 03
227.5	.197545 03	.098215 03	.205474 03	.209381 03	.212775 03	.215849 03	.218727 03	.221482 03	.224168 03	.226834 03
228.0	.198012 03	.097884 03	.205949 03	.209861 03	.213257 03	.216337 03	.219218 03	.221976 03	.224665 03	.227334 03
228.5	.198478 03	.097553 03	.206425 03	.210341 03	.213741 03	.216825 03	.219709 03	.222470 03	.225162 03	.227834 03
229.0	.198944 03	.097222 03	.206901 03	.210822 03	.214225 03	.217313 03	.220200 03	.222964 03	.225659 03	.228334 03
229.5	.199410 03	.096891 03	.207377 03	.211302 03	.214709 03	.217800 03	.220691 03	.223458 03	.226157 03	.228834 03
230.0	.199877 03	.096560 03	.207852 03	.211782 03	.215194 03	.218288 03	.221182 03	.223952 03	.226654 03	.229334 03
230.5	.200343 03	.096229 03	.208328 03	.212263 03	.215678 03	.218776 03	.221673 03	.224446 03	.227151 03	.229834 03
231.0	.200810 03	.095898 03	.208804 03	.212743 03	.216162 03	.219264 03	.222164 03	.224940 03	.227648 03	.230334 03
231.5	.201276 03	.095567 03	.209280 03	.213224 03	.216646 03	.219751 03	.222655 03	.225434 03	.228145 03	.230834 03
232.0	.201743 03	.095236 03	.209756 03	.213704 03	.217131 03	.220239 03	.223146 03	.225928 03	.228642 03	.231334 03
232.5	.202209 03	.094905 03	.210232 03	.214184 03	.217615 03	.220727 03	.223637 03	.226422 03	.229139 03	.231834 03
233.0	.202676 03	.094574 03	.210708 03	.214665 03	.218099 03	.221215 03	.224128 03	.226916 03	.229636 03	.232334 03
233.5	.203143 03	.094243 03	.211184 03	.215145 03	.218584 03	.221703 03	.224619 03	.227411 03	.230133 03	.232834 03
234.0	.203609 03	.093912 03	.211660 03	.215626 03	.219068 03	.222191 03	.225110 03	.227905 03	.230630 03	.233334 03
234.5	.204076 03	.093581 03	.212136 03	.216106 03	.219553 03	.222678 03	.225602 03	.228399 03	.231127 03	.233834 03
235.0	.204543 03	.093250 03	.212612 03	.216587 03	.220037 03	.223166 03	.226093 03	.228893 03	.231624 03	.234334 03
235.5	.205009 03	.092919 03	.213088 03	.217068 03	.220521 03	.223654 03	.226584 03	.229387 03	.232122 03	.234834 03
236.0	.205476 03	.092588 03	.213564 03	.217548 03	.221006 03	.224142 03	.227075 03	.229881 03	.232619 03	.235334 03
236.5	.205943 03	.092257 03	.214040 03	.218029 03	.221490 03	.224630 03	.227566 03	.230375 03	.233116 03	.235834 03
237.0	.206410 03	.091926 03	.214516 03	.218509 03	.221975 03	.225118 03	.228057 03	.230870 03	.233613 03	.236334 03

Percentage Points of the χ^2 -Distribution
Values of χ^2 for Areas of 0 and P

χ^2	0.90000	0.85000	0.80000	0.75000	0.70000	0.60000	0.55000	0.50000
237.5	206877 03	214992 03	216990 03	222459 03	225606 03	231364 03	234110 03	236034 03
238.0	207344 03	215469 03	219471 03	222944 03	226094 03	231658 03	234607 03	237334 03
238.5	207811 03	215945 03	219951 03	223428 03	226582 03	232142 03	235104 03	237834 03
239.0	208278 03	216421 03	220432 03	223913 03	227070 03	232626 03	235601 03	238334 03
239.5	208745 03	216897 03	220913 03	224397 03	227558 03	233110 03	236098 03	238834 03
240.0	209212 03	217374 03	221394 03	224882 03	228046 03	233595 03	236596 03	239334 03
240.5	209679 03	217850 03	221874 03	225367 03	228534 03	234079 03	237093 03	239834 03
241.0	210146 03	218326 03	222355 03	225851 03	229022 03	234562 03	237590 03	240334 03
241.5	210613 03	218803 03	222836 03	226336 03	229510 03	235045 03	238087 03	240834 03
242.0	211081 03	219279 03	223317 03	226822 03	229998 03	235528 03	238584 03	241334 03
242.5	211548 03	219755 03	223798 03	227305 03	230486 03	236016 03	239081 03	241834 03
243.0	212015 03	220232 03	224279 03	227790 03	230974 03	236500 03	239578 03	242334 03
243.5	212483 03	220708 03	224759 03	228274 03	231462 03	236984 03	240076 03	242834 03
244.0	212950 03	221185 03	225240 03	228759 03	231950 03	237468 03	240573 03	243334 03
244.5	213417 03	221661 03	225721 03	229244 03	232438 03	237952 03	241070 03	243834 03
245.0	213885 03	222138 03	226202 03	229729 03	232927 03	238436 03	241567 03	244334 03
245.5	214352 03	222615 03	226683 03	230213 03	233415 03	238924 03	242064 03	244834 03
246.0	214820 03	223091 03	227164 03	230698 03	233903 03	239411 03	242561 03	245334 03
246.5	215287 03	223568 03	227645 03	231183 03	234391 03	240260 03	243058 03	245834 03
247.0	215755 03	224044 03	228126 03	231668 03	234879 03	240748 03	243555 03	246334 03
247.5	216222 03	224521 03	228607 03	232152 03	235367 03	241236 03	244052 03	246834 03
248.0	216690 03	224998 03	229088 03	232637 03	235856 03	241724 03	244549 03	247334 03
248.5	217158 03	225474 03	229569 03	233122 03	236344 03	242212 03	245046 03	247834 03
249.0	217625 03	225951 03	230051 03	233607 03	236832 03	242700 03	245543 03	248334 03
249.5	218093 03	226428 03	230532 03	234092 03	237320 03	243188 03	246040 03	248834 03
250.0	218561 03	226905 03	231013 03	234577 03	237809 03	243676 03	246537 03	249334 03
250.5	219029 03	227382 03	231494 03	235062 03	238297 03	244164 03	247034 03	249834 03
251.0	219497 03	227858 03	231975 03	235547 03	238785 03	244652 03	247531 03	250334 03
251.5	219964 03	228335 03	232456 03	236032 03	239273 03	245140 03	248028 03	250834 03
252.0	220432 03	228812 03	232938 03	236516 03	239762 03	245628 03	248525 03	251334 03
252.5	220900 03	229289 03	233419 03	237001 03	240250 03	246116 03	249022 03	251834 03
253.0	221368 03	229766 03	233900 03	237486 03	240738 03	246604 03	249519 03	252334 03
253.5	221836 03	230243 03	234381 03	237971 03	241227 03	247092 03	250016 03	252834 03
254.0	222304 03	230720 03	234863 03	238456 03	241715 03	247576 03	250513 03	253334 03
254.5	222772 03	231197 03	235344 03	238941 03	242203 03	248060 03	251010 03	253834 03
255.0	223240 03	231674 03	235825 03	239426 03	242692 03	248548 03	251507 03	254334 03
255.5	223708 03	232151 03	236307 03	239912 03	243180 03	249036 03	252004 03	254834 03
256.0	224177 03	232628 03	236788 03	240397 03	243668 03	249524 03	252501 03	255334 03
256.5	224645 03	233105 03	237269 03	240882 03	244157 03	250012 03	253002 03	255834 03
257.0	225113 03	233582 03	237751 03	241367 03	244645 03	250500 03	253500 03	256334 03
257.5	225581 03	234059 03	238232 03	241852 03	245134 03	251136 03	253997 03	256834 03
258.0	226049 03	234536 03	238714 03	242337 03	245622 03	251630 03	254494 03	257334 03
258.5	226518 03	235014 03	239195 03	242822 03	246111 03	252124 03	254991 03	257834 03
259.0	226986 03	235491 03	239677 03	243307 03	246599 03	252619 03	255488 03	258334 03
259.5	227454 03	235968 03	240158 03	243792 03	247087 03	253113 03	255986 03	258834 03
260.0	227923 03	236445 03	240640 03	244278 03	247576 03	253608 03	256483 03	259334 03
260.5	228391 03	236922 03	241121 03	244763 03	248064 03	254102 03	256980 03	259834 03
261.0	228860 03	237400 03	241603 03	245248 03	248553 03	254597 03	257477 03	260334 03
261.5	229328 03	237877 03	242084 03	245733 03	249041 03	255091 03	257975 03	260834 03
262.0	229797 03	238354 03	242566 03	246219 03	249530 03	255586 03	258472 03	261334 03

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
262.5	.230265 03	.233597 03	.238832 03	.243047 03	.247704 03	.250019 03	.253117 03	.256000 03	.259969 03	.500000
263.0	.230734 03	.234069 03	.239309 03	.243529 03	.247169 03	.250507 03	.253600 03	.256574 03	.259466 03	.261834 03
263.5	.231202 03	.234542 03	.239786 03	.244011 03	.247674 03	.250996 03	.254100 03	.257069 03	.259964 03	.262334 03
264.0	.231671 03	.235014 03	.240264 03	.244492 03	.248160 03	.251483 03	.254591 03	.257563 03	.260461 03	.262834 03
264.5	.232140 03	.235486 03	.240741 03	.244974 03	.248645 03	.251973 03	.255083 03	.258058 03	.260958 03	.263334 03
265.0	.232608 03	.235956 03	.241219 03	.245456 03	.249130 03	.252461 03	.255575 03	.258552 03	.261455 03	.263834 03
265.5	.233077 03	.236430 03	.241696 03	.245937 03	.249616 03	.252950 03	.256066 03	.259047 03	.261953 03	.264334 03
266.0	.233546 03	.236902 03	.242174 03	.246419 03	.250101 03	.253439 03	.256558 03	.259541 03	.262450 03	.264834 03
266.5	.234015 03	.237374 03	.242651 03	.246891 03	.250586 03	.253927 03	.257049 03	.260036 03	.262947 03	.265334 03
267.0	.234483 03	.237847 03	.243129 03	.247363 03	.251072 03	.254416 03	.257541 03	.260530 03	.263445 03	.265834 03
267.5	.234952 03	.238319 03	.244006 03	.248246 03	.251957 03	.255304 03	.258433 03	.261425 03	.264342 03	.266734 03
268.0	.235421 03	.238791 03	.244484 03	.248736 03	.252502 03	.255853 03	.258983 03	.261979 03	.264903 03	.267334 03
268.5	.235890 03	.239263 03	.244961 03	.249228 03	.252928 03	.256284 03	.259414 03	.262508 03	.265436 03	.267834 03
269.0	.236359 03	.239736 03	.245439 03	.249710 03	.253413 03	.256774 03	.259904 03	.262992 03	.265926 03	.268334 03
269.5	.236828 03	.240208 03	.245891 03	.250166 03	.253874 03	.257239 03	.260369 03	.263822 03	.266756 03	.269134 03
270.0	.237297 03	.240680 03	.246344 03	.250614 03	.254328 03	.257698 03	.260828 03	.264252 03	.267186 03	.269534 03
270.5	.237766 03	.241153 03	.246894 03	.251183 03	.254903 03	.258278 03	.261307 03	.264700 03	.267634 03	.270034 03
271.0	.238235 03	.241625 03	.247472 03	.251959 03	.255683 03	.259058 03	.262076 03	.265439 03	.268373 03	.270734 03
271.5	.238704 03	.242098 03	.247947 03	.252437 03	.256167 03	.259541 03	.262500 03	.265843 03	.268776 03	.271134 03
272.0	.239173 03	.242570 03	.248495 03	.252910 03	.256639 03	.259998 03	.263000 03	.266323 03	.269256 03	.271534 03
272.5	.239642 03	.243043 03	.249016 03	.253463 03	.257191 03	.260546 03	.263922 03	.267215 03	.270148 03	.271934 03
273.0	.240111 03	.243515 03	.249506 03	.254073 03	.257808 03	.261161 03	.264500 03	.267763 03	.270696 03	.272434 03
273.5	.240581 03	.243988 03	.249994 03	.254673 03	.258413 03	.261774 03	.265083 03	.268316 03	.271249 03	.272934 03
274.0	.241050 03	.244466 03	.250476 03	.255093 03	.258840 03	.262300 03	.265569 03	.268763 03	.271802 03	.273434 03
274.5	.241519 03	.244933 03	.250954 03	.255593 03	.259346 03	.262883 03	.266116 03	.269270 03	.271855 03	.273434 03
275.0	.241988 03	.245406 03	.251436 03	.256093 03	.259853 03	.263400 03	.266593 03	.269716 03	.271908 03	.273434 03
275.5	.242457 03	.245876 03	.251936 03	.256613 03	.260380 03	.263863 03	.267006 03	.270090 03	.272143 03	.273634 03
276.0	.242927 03	.246346 03	.252436 03	.257133 03	.261000 03	.264443 03	.267546 03	.270570 03	.272623 03	.274134 03
276.5	.243396 03	.246814 03	.252936 03	.257653 03	.261500 03	.264913 03	.268006 03	.271000 03	.273053 03	.274534 03
277.0	.243866 03	.247284 03	.253436 03	.258173 03	.262000 03	.265383 03	.268446 03	.271400 03	.273453 03	.274934 03
277.5	.244335 03	.247769 03	.253936 03	.258693 03	.262500 03	.265843 03	.268866 03	.271800 03	.273853 03	.275334 03
278.0	.244804 03	.248242 03	.254436 03	.259213 03	.263000 03	.266303 03	.269276 03	.272200 03	.274253 03	.275734 03
278.5	.245274 03	.248715 03	.254936 03	.259733 03	.263500 03	.266763 03	.269676 03	.272600 03	.274653 03	.276134 03
279.0	.245743 03	.249188 03	.255436 03	.260233 03	.264000 03	.267213 03	.270076 03	.272900 03	.274953 03	.276434 03
279.5	.246213 03	.249660 03	.255936 03	.260733 03	.264500 03	.267673 03	.270476 03	.273250 03	.275303 03	.276734 03
280.0	.246682 03	.250133 03	.256436 03	.261233 03	.265000 03	.268143 03	.270876 03	.273600 03	.275653 03	.277034 03
280.5	.247152 03	.250606 03	.256936 03	.261733 03	.265500 03	.268593 03	.271276 03	.274000 03	.276053 03	.277434 03
281.0	.247622 03	.251079 03	.257436 03	.262233 03	.266000 03	.269043 03	.271700 03	.274400 03	.276453 03	.277834 03
281.5	.248091 03	.251552 03	.257936 03	.262733 03	.266500 03	.269493 03	.272100 03	.274750 03	.276803 03	.278134 03
282.0	.248561 03	.252025 03	.258436 03	.263233 03	.267000 03	.270000 03	.272400 03	.275000 03	.277053 03	.278334 03
282.5	.249031 03	.252498 03	.258936 03	.263733 03	.267500 03	.270450 03	.272800 03	.275350 03	.277403 03	.278634 03
283.0	.249500 03	.252971 03	.259436 03	.264233 03	.268000 03	.270900 03	.273200 03	.275700 03	.277753 03	.278934 03
283.5	.249970 03	.253444 03	.259893 03	.264733 03	.268500 03	.271350 03	.273600 03	.276100 03	.278153 03	.279334 03
284.0	.250440 03	.253917 03	.260366 03	.265233 03	.269000 03	.271800 03	.274000 03	.276500 03	.278553 03	.279734 03
284.5	.250909 03	.254390 03	.260836 03	.265733 03	.269500 03	.271900 03	.274100 03	.276600 03	.278653 03	.279834 03
285.0	.251379 03	.254854 03	.261306 03	.266233 03	.270000 03	.272400 03	.274500 03	.277000 03	.279053 03	.280234 03
285.5	.251849 03	.255337 03	.261776 03	.266733 03	.270500 03	.272900 03	.275000 03	.277500 03	.279553 03	.280734 03
286.0	.252319 03	.255810 03	.262206 03	.267233 03	.271000 03	.273400 03	.275500 03	.278000 03	.280053 03	.281234 03
286.5	.252789 03	.256283 03	.262636 03	.267733 03	.271500 03	.273900 03	.276000 03	.278500 03	.280553 03	.281734 03
287.0	.253259 03	.256756 03	.263066 03	.268233 03	.272000 03	.274400 03	.276500 03	.279000 03	.281053 03	.282234 03

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

ν	.92500	.90000	.85000	.80000	.75000	.70000	.65000	.60000	.55000	.50000
287.5	.253729 03	.257279 03	.262725 03	.267149 03	.270964 03	.274459 03	.277705 03	.280809 03	.283635 03	.286134 03
288.0	.254199 03	.257749 03	.263195 03	.267621 03	.271436 03	.274931 03	.278182 03	.281286 03	.284012 03	.286511 03
288.5	.254669 03	.258219 03	.263665 03	.268091 03	.271906 03	.275401 03	.278652 03	.281756 03	.284482 03	.286981 03
289.0	.255139 03	.258689 03	.264135 03	.268561 03	.272376 03	.275871 03	.279122 03	.282226 03	.284952 03	.287451 03
289.5	.255609 03	.259159 03	.264605 03	.269031 03	.272846 03	.276341 03	.279592 03	.282696 03	.285422 03	.287921 03
290.0	.256079 03	.259629 03	.265075 03	.269501 03	.273316 03	.276811 03	.280062 03	.283166 03	.285892 03	.288391 03
290.5	.256549 03	.260099 03	.265545 03	.270000 03	.273815 03	.277310 03	.280561 03	.283665 03	.286391 03	.288890 03
291.0	.257019 03	.260569 03	.266015 03	.270470 03	.274285 03	.277780 03	.281031 03	.284135 03	.286861 03	.289360 03
291.5	.257489 03	.261039 03	.266485 03	.270940 03	.274755 03	.278250 03	.281501 03	.284605 03	.287331 03	.289830 03
292.0	.257959 03	.261509 03	.266955 03	.271410 03	.275225 03	.278720 03	.281971 03	.285075 03	.287801 03	.290300 03
292.5	.258430 03	.261980 03	.267425 03	.271880 03	.275695 03	.279190 03	.282441 03	.285545 03	.288271 03	.290770 03
293.0	.258900 03	.262450 03	.267895 03	.272340 03	.276155 03	.279650 03	.282901 03	.286005 03	.288731 03	.291230 03
293.5	.259370 03	.262940 03	.268385 03	.272800 03	.276615 03	.280110 03	.283361 03	.286465 03	.289191 03	.291690 03
294.0	.259840 03	.263410 03	.268855 03	.273260 03	.277075 03	.280570 03	.283821 03	.286925 03	.289651 03	.292190 03
294.5	.260311 03	.263881 03	.269325 03	.273720 03	.277535 03	.281030 03	.284281 03	.287385 03	.290111 03	.292610 03
295.0	.260781 03	.264351 03	.269795 03	.274180 03	.278000 03	.281495 03	.284746 03	.287850 03	.290576 03	.293075 03
295.5	.261251 03	.264821 03	.270235 03	.274630 03	.278450 03	.281945 03	.285196 03	.288300 03	.291026 03	.293525 03
296.0	.261722 03	.265292 03	.270705 03	.275100 03	.278920 03	.282415 03	.285666 03	.288770 03	.291496 03	.294000 03
296.5	.262192 03	.265762 03	.270745 03	.275140 03	.278960 03	.282455 03	.285706 03	.288810 03	.291536 03	.294040 03
297.0	.262663 03	.266233 03	.271185 03	.275580 03	.279400 03	.282895 03	.286146 03	.289250 03	.291976 03	.294480 03
297.5	.263133 03	.266703 03	.272125 03	.276520 03	.280340 03	.283835 03	.287086 03	.290190 03	.292916 03	.295420 03
298.0	.263603 03	.267173 03	.272165 03	.276560 03	.280380 03	.283875 03	.287126 03	.290230 03	.292956 03	.295460 03
298.5	.264074 03	.267644 03	.272635 03	.277030 03	.280850 03	.284345 03	.287596 03	.290700 03	.293426 03	.295930 03
299.0	.264545 03	.268115 03	.273105 03	.277500 03	.281320 03	.284815 03	.288066 03	.291170 03	.293896 03	.296400 03
299.5	.265015 03	.268585 03	.273575 03	.277970 03	.281790 03	.285285 03	.288536 03	.291640 03	.294366 03	.296870 03
300.0	.265486 03	.269056 03	.274045 03	.278440 03	.282260 03	.285755 03	.289006 03	.292110 03	.294836 03	.297340 03
300.5	.265956 03	.269526 03	.274515 03	.278910 03	.282730 03	.286225 03	.289476 03	.292580 03	.295306 03	.297810 03
301.0	.266427 03	.270000 03	.274980 03	.279375 03	.283195 03	.286690 03	.290000 03	.293100 03	.295826 03	.298330 03
301.5	.266898 03	.270470 03	.275450 03	.279845 03	.283665 03	.287160 03	.290470 03	.293570 03	.296300 03	.298800 03
302.0	.267368 03	.270940 03	.275920 03	.280315 03	.284135 03	.287630 03	.290940 03	.294040 03	.296770 03	.299270 03
302.5	.267839 03	.271410 03	.276390 03	.280785 03	.284605 03	.288100 03	.291410 03	.294510 03	.297240 03	.299740 03
303.0	.268310 03	.271880 03	.276860 03	.281255 03	.285075 03	.288570 03	.291880 03	.294980 03	.297710 03	.300210 03
303.5	.268780 03	.272350 03	.277330 03	.281720 03	.285540 03	.289035 03	.292340 03	.295440 03	.298170 03	.300670 03
304.0	.269251 03	.272821 03	.277800 03	.282190 03	.286010 03	.289505 03	.292810 03	.295910 03	.298640 03	.301130 03
304.5	.269722 03	.273292 03	.278270 03	.282660 03	.286480 03	.290000 03	.293310 03	.296410 03	.299140 03	.301590 03
305.0	.270193 03	.273763 03	.278740 03	.283130 03	.286950 03	.290470 03	.293780 03	.296880 03	.299610 03	.302050 03
305.5	.270664 03	.274234 03	.279210 03	.283600 03	.287420 03	.290940 03	.294250 03	.297350 03	.300080 03	.302540 03
306.0	.271134 03	.274704 03	.279680 03	.284070 03	.287890 03	.291410 03	.294720 03	.297820 03	.300550 03	.303040 03
306.5	.271605 03	.275175 03	.280150 03	.284540 03	.288360 03	.291880 03	.295190 03	.298290 03	.301020 03	.303530 03
307.0	.272076 03	.275646 03	.280620 03	.285010 03	.288830 03	.292350 03	.295660 03	.298760 03	.301490 03	.304000 03
307.5	.272547 03	.276117 03	.281090 03	.285480 03	.289300 03	.292820 03	.296130 03	.299230 03	.301960 03	.304470 03
308.0	.273018 03	.276588 03	.281560 03	.285950 03	.289770 03	.293290 03	.296600 03	.299700 03	.302430 03	.304930 03
308.5	.273489 03	.277059 03	.282030 03	.286420 03	.290240 03	.293760 03	.297070 03	.300170 03	.302900 03	.305390 03
309.0	.273960 03	.277530 03	.282500 03	.286890 03	.290710 03	.294230 03	.297540 03	.300640 03	.303370 03	.305850 03
309.5	.274431 03	.278001 03	.282970 03	.287360 03	.291280 03	.294800 03	.298110 03	.301210 03	.303940 03	.306310 03
310.0	.274902 03	.278472 03	.283440 03	.287830 03	.291800 03	.295320 03	.298630 03	.301730 03	.304460 03	.306770 03
310.5	.275373 03	.278943 03	.283910 03	.288300 03	.292320 03	.295840 03	.299150 03	.302250 03	.304980 03	.307230 03
311.0	.275844 03	.279414 03	.284380 03	.288770 03	.292790 03	.296310 03	.299620 03	.302720 03	.305440 03	.307690 03
311.5	.276315 03	.279885 03	.284850 03	.289240 03	.293260 03	.296780 03	.300090 03	.303190 03	.305900 03	.308150 03
312.0	.276787 03	.280357 03	.285320 03	.289710 03	.293630 03	.297150 03	.300460 03	.303560 03	.306290 03	.308750 03

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

ν	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
312.5	.272258 03	.283920 03	.286666 03	.291289 03	.295294 03	.298923 03	.302311 03	.305551 03	.308786 03	.311834 03
313.0	.277720 03	.283394 03	.287145 03	.291772 03	.295761 03	.299432 03	.302804 03	.306045 03	.309284 03	.312334 03
313.5	.278200 03	.281869 03	.287625 03	.292255 03	.296267 03	.299982 03	.303296 03	.306540 03	.309701 03	.312834 03
314.0	.278672 03	.282343 03	.288104 03	.292738 03	.296754 03	.300481 03	.303788 03	.307035 03	.310199 03	.313334 03
314.5	.279143 03	.282817 03	.288583 03	.293221 03	.297240 03	.301000 03	.304280 03	.307530 03	.310696 03	.313834 03
315.0	.279614 03	.283292 03	.289062 03	.293750 03	.297772 03	.301570 03	.304823 03	.308085 03	.311194 03	.314334 03
315.5	.280085 03	.283766 03	.289542 03	.294188 03	.298213 03	.302060 03	.305265 03	.308520 03	.311691 03	.314834 03
316.0	.280556 03	.284241 03	.290021 03	.294671 03	.298700 03	.302589 03	.305757 03	.309015 03	.312189 03	.315334 03
316.5	.281026 03	.284715 03	.290501 03	.295154 03	.299186 03	.303039 03	.306250 03	.309510 03	.312686 03	.315834 03
317.0	.281499 03	.285190 03	.290980 03	.295636 03	.299673 03	.303488 03	.306742 03	.310005 03	.313184 03	.316334 03
317.5	.281971 03	.285664 03	.291459 03	.296121 03	.300160 03	.303988 03	.307234 03	.310500 03	.313681 03	.316834 03
318.0	.282442 03	.286139 03	.291939 03	.296604 03	.300646 03	.304384 03	.307727 03	.311095 03	.314279 03	.317334 03
318.5	.282914 03	.286614 03	.292418 03	.297087 03	.301133 03	.304879 03	.308219 03	.311490 03	.314676 03	.317834 03
319.0	.283385 03	.287088 03	.292608 03	.297271 03	.301320 03	.305076 03	.308411 03	.311685 03	.314874 03	.318034 03
319.5	.283857 03	.287563 03	.293137 03	.297805 03	.302006 03	.305766 03	.309104 03	.312375 03	.315571 03	.318834 03
320.0	.284328 03	.288037 03	.293857 03	.298534 03	.302739 03	.306526 03	.309866 03	.313149 03	.316349 03	.319634 03
320.5	.284800 03	.288512 03	.294336 03	.299021 03	.303763 03	.307556 03	.310899 03	.314170 03	.317366 03	.320634 03
321.0	.285271 03	.288987 03	.294816 03	.299504 03	.303566 03	.307355 03	.310701 03	.313965 03	.317164 03	.320434 03
321.5	.285743 03	.289461 03	.295295 03	.299988 03	.304053 03	.307843 03	.311173 03	.314460 03	.317662 03	.320834 03
322.0	.286214 03	.289936 03	.295775 03	.300471 03	.304540 03	.308325 03	.311666 03	.314955 03	.318159 03	.321334 03
322.5	.286686 03	.290411 03	.296254 03	.300954 03	.305026 03	.308814 03	.312150 03	.315450 03	.318657 03	.321834 03
323.0	.287158 03	.290686 03	.297134 03	.301438 03	.305513 03	.309294 03	.312631 03	.315940 03	.319154 03	.322334 03
323.5	.287629 03	.291160 03	.297613 03	.301921 03	.306000 03	.309784 03	.313143 03	.316440 03	.319652 03	.322834 03
324.0	.288101 03	.291635 03	.298093 03	.302405 03	.306486 03	.310273 03	.313635 03	.316935 03	.320149 03	.323334 03
324.5	.288573 03	.292110 03	.298573 03	.302888 03	.306973 03	.310763 03	.314128 03	.317430 03	.320647 03	.323834 03
325.0	.289045 03	.292587 03	.299052 03	.303372 03	.307460 03	.311253 03	.314620 03	.317920 03	.321144 03	.324334 03
325.5	.289516 03	.293060 03	.299532 03	.303855 03	.307947 03	.311742 03	.315113 03	.318420 03	.321642 03	.324834 03
326.0	.289988 03	.293535 03	.299912 03	.304339 03	.308433 03	.312342 03	.315705 03	.318915 03	.322139 03	.325334 03
326.5	.290460 03	.293920 03	.300291 03	.304822 03	.308920 03	.312832 03	.316198 03	.319410 03	.322637 03	.325834 03
327.0	.290932 03	.294384 03	.300771 03	.305306 03	.309407 03	.313321 03	.316690 03	.319905 03	.323134 03	.326334 03
327.5	.291404 03	.294859 03	.301051 03	.305789 03	.309894 03	.313811 03	.317183 03	.320400 03	.323632 03	.326834 03
328.0	.291875 03	.295334 03	.301531 03	.306273 03	.310381 03	.314291 03	.317653 03	.320895 03	.324129 03	.327334 03
328.5	.292347 03	.295809 03	.302010 03	.306756 03	.310867 03	.314779 03	.318143 03	.321390 03	.324627 03	.327834 03
329.0	.292819 03	.296284 03	.302490 03	.307240 03	.311354 03	.315260 03	.318626 03	.321885 03	.325124 03	.328334 03
329.5	.293291 03	.296763 03	.303297 03	.307723 03	.311841 03	.315750 03	.319117 03	.322380 03	.325622 03	.328834 03
330.0	.293763 03	.297234 03	.303723 03	.308207 03	.312328 03	.316238 03	.319606 03	.322875 03	.326120 03	.329334 03
330.5	.294235 03	.298009 03	.304329 03	.308891 03	.312815 03	.316725 03	.320097 03	.323370 03	.326617 03	.329834 03
331.0	.294707 03	.298484 03	.304809 03	.309374 03	.313302 03	.317212 03	.320580 03	.323865 03	.327115 03	.330334 03
331.5	.295179 03	.298959 03	.305489 03	.310058 03	.313789 03	.317709 03	.321072 03	.324361 03	.327612 03	.330834 03
332.0	.295651 03	.299435 03	.305369 03	.310141 03	.314275 03	.318199 03	.321515 03	.324805 03	.328110 03	.331334 03
332.5	.296123 03	.299910 03	.305849 03	.310625 03	.314762 03	.318699 03	.322007 03	.325351 03	.328667 03	.331834 03
333.0	.296595 03	.300385 03	.306329 03	.311109 03	.315249 03	.319199 03	.322500 03	.325846 03	.329105 03	.332334 03
333.5	.297067 03	.300860 03	.306809 03	.311592 03	.315736 03	.319689 03	.322992 03	.326341 03	.329603 03	.332834 03
334.0	.297539 03	.301335 03	.307289 03	.312076 03	.316223 03	.320179 03	.323485 03	.326836 03	.330100 03	.333334 03
334.5	.298011 03	.301810 03	.307769 03	.312560 03	.316710 03	.320668 03	.323978 03	.327331 03	.330598 03	.333834 03
335.0	.298484 03	.302286 03	.308248 03	.313044 03	.317197 03	.321158 03	.324470 03	.327826 03	.331095 03	.334334 03
335.5	.298956 03	.302761 03	.308728 03	.313527 03	.317684 03	.321648 03	.324963 03	.328321 03	.331593 03	.334834 03
336.0	.299428 03	.303236 03	.309200 03	.314011 03	.318171 03	.322138 03	.325455 03	.328816 03	.332090 03	.335334 03
336.5	.299900 03	.303371 03	.309368 03	.314495 03	.318658 03	.322628 03	.325948 03	.329311 03	.332588 03	.335834 03
337.0	.300373 03	.304117 03	.310168 03	.314979 03	.319145 03	.323118 03	.326440 03	.329807 03	.333065 03	.336334 03

Percentage Points of the χ^2 -Distribution
 Values of χ^2 in Terms of Q and ν

ν	.925000	.900000	.850000	.800000	.750000	.700000	.650000	.600000	.550000	.500000
337.5	308045 03	304662 03	310640 03	315462 03	319632 03	323408 03	326933 03	330302 03	333583 03	336834 03
338.0	308137 03	304737 03	311229 03	315946 03	320119 03	323898 03	327425 03	330797 03	334081 03	337334 03
338.5	308179 03	304780 03	311269 03	315986 03	320160 03	323937 03	327456 03	331292 03	334578 03	337834 03
339.0	308222 03	304822 03	311309 03	316026 03	320200 03	324077 03	327505 03	331787 03	335076 03	338334 03
339.5	308264 03	304864 03	311349 03	316066 03	320240 03	324117 03	327544 03	332272 03	335573 03	338834 03
340.0	308307 03	304907 03	311389 03	316106 03	320280 03	324157 03	327583 03	332757 03	336071 03	339334 03
340.5	308349 03	304949 03	311429 03	316146 03	320320 03	324197 03	327622 03	333242 03	336569 03	339834 03
341.0	308391 03	304991 03	311469 03	316186 03	320360 03	324237 03	327661 03	333727 03	337066 03	340334 03
341.5	308433 03	305033 03	311509 03	316226 03	320400 03	324277 03	327700 03	334212 03	337564 03	340834 03
342.0	308475 03	305075 03	311549 03	316266 03	320440 03	324317 03	327739 03	334697 03	338061 03	341334 03
342.5	308517 03	305117 03	311589 03	316306 03	320480 03	324357 03	327778 03	335182 03	338559 03	341834 03
343.0	308559 03	305159 03	311629 03	316346 03	320520 03	324397 03	327817 03	335667 03	339057 03	342334 03
343.5	308601 03	305201 03	311669 03	316386 03	320560 03	324437 03	327856 03	336152 03	339554 03	342834 03
344.0	308643 03	305243 03	311709 03	316426 03	320600 03	324477 03	327895 03	336637 03	340052 03	343334 03
344.5	308685 03	305285 03	311749 03	316466 03	320640 03	324517 03	327934 03	337122 03	340549 03	343834 03
345.0	308727 03	305327 03	311789 03	316506 03	320680 03	324557 03	327973 03	337597 03	341047 03	344334 03
345.5	308769 03	305369 03	311829 03	316546 03	320720 03	324597 03	328012 03	338072 03	341545 03	344834 03
346.0	308811 03	305411 03	311869 03	316586 03	320760 03	324637 03	328051 03	338547 03	342042 03	345334 03
346.5	308853 03	305453 03	311909 03	316626 03	320800 03	324677 03	328090 03	339022 03	342540 03	345834 03
347.0	308895 03	305495 03	311949 03	316666 03	320840 03	324717 03	328129 03	339497 03	343037 03	346334 03
347.5	308937 03	305537 03	311989 03	316706 03	320880 03	324757 03	328168 03	339972 03	343535 03	346834 03
348.0	308979 03	305579 03	312029 03	316746 03	320920 03	324797 03	328207 03	340447 03	344033 03	347334 03
348.5	309021 03	305621 03	312069 03	316786 03	320960 03	324837 03	328246 03	340922 03	344530 03	347834 03
349.0	309063 03	305663 03	312109 03	316826 03	321000 03	324877 03	328285 03	341397 03	345028 03	348334 03
349.5	309105 03	305705 03	312149 03	316866 03	321040 03	324917 03	328324 03	341872 03	345525 03	348834 03
350.0	309147 03	305747 03	312189 03	316906 03	321080 03	324957 03	328363 03	342347 03	346023 03	349334 03
350.5	309189 03	305789 03	312229 03	316946 03	321120 03	324997 03	328402 03	342822 03	346521 03	349834 03
351.0	309231 03	305831 03	312269 03	316986 03	321160 03	325037 03	328441 03	343297 03	347018 03	350334 03
351.5	309273 03	305873 03	312309 03	317026 03	321200 03	325077 03	328480 03	343772 03	347516 03	350834 03
352.0	309315 03	305915 03	312349 03	317066 03	321240 03	325117 03	328519 03	344247 03	348014 03	351334 03
352.5	309357 03	305957 03	312389 03	317106 03	321280 03	325157 03	328558 03	344722 03	348511 03	351834 03
353.0	309400 03	306000 03	312429 03	317146 03	321320 03	325197 03	328597 03	345197 03	349009 03	352334 03
353.5	309442 03	306042 03	312469 03	317186 03	321360 03	325237 03	328636 03	345672 03	349506 03	352834 03
354.0	309484 03	306084 03	312509 03	317226 03	321400 03	325277 03	328675 03	346147 03	350004 03	353334 03
354.5	309526 03	306126 03	312549 03	317266 03	321440 03	325317 03	328714 03	346622 03	350502 03	353834 03
355.0	309568 03	306168 03	312589 03	317306 03	321480 03	325357 03	328753 03	347097 03	350999 03	354334 03
355.5	309610 03	306210 03	312629 03	317346 03	321520 03	325397 03	328792 03	347572 03	351497 03	354834 03
356.0	309652 03	306252 03	312669 03	317386 03	321560 03	325437 03	328831 03	348047 03	351995 03	355334 03
356.5	309694 03	306294 03	312709 03	317426 03	321600 03	325477 03	328870 03	348522 03	352492 03	355834 03
357.0	309736 03	306336 03	312749 03	317466 03	321640 03	325517 03	328909 03	348997 03	352990 03	356334 03
357.5	309778 03	306378 03	312789 03	317506 03	321680 03	325557 03	328948 03	349472 03	353488 03	356834 03
358.0	309820 03	306420 03	312829 03	317546 03	321720 03	325597 03	328987 03	349947 03	353985 03	357334 03
358.5	309862 03	306462 03	312869 03	317586 03	321760 03	325637 03	329026 03	350422 03	354483 03	357834 03
359.0	309904 03	306504 03	312909 03	317626 03	321800 03	325677 03	329065 03	350897 03	354980 03	358334 03
359.5	309946 03	306546 03	312949 03	317666 03	321840 03	325717 03	329104 03	351372 03	355478 03	358834 03
360.0	309988 03	306588 03	312989 03	317706 03	321880 03	325757 03	329143 03	351847 03	355976 03	359334 03
360.5	310030 03	306630 03	313029 03	317746 03	321920 03	325797 03	329182 03	352322 03	356474 03	359834 03
361.0	310072 03	306672 03	313069 03	317786 03	321960 03	325837 03	329221 03	352797 03	356971 03	360334 03
361.5	310114 03	306714 03	313109 03	317826 03	322000 03	325877 03	329260 03	353272 03	357469 03	360834 03
362.0	310156 03	306756 03	313149 03	317866 03	322040 03	325917 03	329299 03	353747 03	357967 03	361334 03

Values of χ^2 in Terms of Q and ν

$\nu/2$	.925000	.900000	.850000	.750000	.700000	.650000	.600000	.550000	.500000
362.5	.324403	.328450	.334660	.343994	.347911	.351568	.355062	.358484	.361834
363.0	.324957	.329004	.335214	.344548	.348465	.352122	.355616	.359038	.362388
363.5	.325511	.329558	.335768	.345102	.349019	.352676	.356170	.359592	.362942
364.0	.326065	.330112	.336322	.345656	.349573	.353230	.356724	.360146	.363496
364.5	.326619	.330666	.336876	.346210	.350127	.353784	.357278	.360700	.364050
365.0	.327173	.331220	.337430	.346764	.350681	.354338	.357832	.361254	.364604
365.5	.327727	.331774	.337984	.347598	.351515	.355172	.358666	.362088	.365438
366.0	.328281	.332328	.338538	.348132	.352049	.355706	.359190	.362612	.365962
366.5	.328835	.332882	.339092	.348666	.352583	.356240	.359724	.363146	.366512
367.0	.329389	.333436	.339646	.349200	.353117	.356774	.360258	.363680	.367030
367.5	.329943	.333990	.340200	.349734	.353654	.357311	.360795	.364217	.367564
368.0	.330497	.334544	.340754	.350268	.354205	.357862	.361346	.364768	.368118
368.5	.331051	.335098	.341308	.350802	.354739	.358396	.361880	.365332	.368682
369.0	.331605	.335652	.341862	.351336	.355273	.358930	.362414	.365866	.369216
369.5	.332159	.336206	.342416	.351870	.355807	.359464	.362948	.366400	.369750
370.0	.332713	.336760	.342970	.352404	.356341	.360000	.363534	.366986	.370336
370.5	.333267	.337314	.343524	.352938	.356875	.360538	.364072	.367524	.370876
371.0	.333821	.337868	.344078	.353472	.357409	.361072	.364606	.368058	.371420
371.5	.334375	.338422	.344628	.354006	.357943	.361606	.365140	.368592	.371964
372.0	.334929	.338976	.345178	.354540	.358477	.362140	.365674	.369126	.372508
372.5	.335483	.339530	.345728	.355074	.359011	.362674	.366208	.369660	.373052
373.0	.336037	.340076	.346278	.355608	.359545	.363208	.366742	.370194	.373596
373.5	.336591	.340620	.346828	.356142	.360079	.363742	.367276	.370730	.374140
374.0	.337145	.341164	.347378	.356676	.360613	.364286	.367820	.371264	.374684
374.5	.337699	.341708	.347928	.357210	.361147	.364820	.368354	.371798	.375228
375.0	.338253	.342252	.348478	.357744	.361681	.365354	.368888	.372332	.375772
375.5	.338807	.342796	.349028	.358278	.362215	.365888	.369422	.372866	.376316
376.0	.339361	.343340	.349578	.358812	.362749	.366422	.370000	.373390	.376860
376.5	.339915	.343884	.350128	.359346	.363283	.366956	.370534	.373924	.377404
377.0	.340469	.344428	.350678	.359880	.363817	.367489	.371068	.374458	.377948
377.5	.341023	.344972	.351228	.360414	.364351	.368023	.371602	.375052	.378492
378.0	.341577	.345526	.351728	.360948	.364885	.368557	.372136	.375586	.379036
378.5	.342131	.346080	.352278	.361482	.365419	.369091	.372670	.376120	.379560
379.0	.342685	.346634	.352828	.362016	.365953	.369625	.373204	.376654	.380094
379.5	.343239	.347188	.353378	.362550	.366487	.370157	.373738	.377188	.380638
380.0	.343793	.347742	.353928	.363084	.367021	.370693	.374272	.377722	.381182
380.5	.344347	.348296	.354478	.363618	.367555	.371227	.374806	.378256	.381726
381.0	.344901	.348850	.355028	.364152	.368089	.371761	.375340	.378790	.382270
381.5	.345455	.349404	.355578	.364686	.368623	.372295	.375874	.379324	.382814
382.0	.346009	.350058	.356128	.365220	.369157	.372829	.376408	.379858	.383358
382.5	.346563	.350612	.356678	.365754	.369691	.373363	.376942	.380392	.383902
383.0	.347117	.351166	.357228	.366288	.370225	.373895	.377474	.380938	.384442
383.5	.347671	.351720	.357788	.366822	.370759	.374427	.377996	.381472	.384986
384.0	.348225	.352274	.358348	.367356	.371293	.374925	.378494	.382016	.385530
384.5	.348779	.352828	.358918	.367890	.371827	.375457	.379026	.382560	.386074
385.0	.349333	.353382	.359462	.368424	.372361	.376000	.379569	.383104	.386618
385.5	.349887	.353931	.359998	.368958	.372895	.376534	.380103	.383648	.387162
386.0	.350441	.354490	.360558	.369492	.373429	.377068	.380642	.384192	.387706
386.5	.350995	.355044	.361092	.370026	.373963	.377602	.381181	.384730	.388250
387.0	.351549	.355598	.361636	.370560	.374497	.378136	.381720	.385260	.388804

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

ν	.92500	.90000	.85000	.80000	.75000	.70000	.65000	.60000	.55000	.50000
462.5	4.19459	4.23976	4.31050	4.36728	4.41639	4.46081	4.50223	4.54177	4.58025	4.61834
463.0	4.19935	4.24455	4.31533	4.37214	4.42126	4.46572	4.50717	4.54673	4.58523	4.62334
463.5	4.20412	4.24934	4.32016	4.37700	4.42617	4.47063	4.51210	4.55169	4.59021	4.62834
464.0	4.20888	4.25413	4.32499	4.38187	4.43106	4.47553	4.51704	4.55665	4.59519	4.63334
464.5	4.21364	4.25892	4.32982	4.38673	4.43595	4.48046	4.52198	4.56161	4.60017	4.63834
465.0	4.21841	4.26371	4.33465	4.39159	4.44084	4.48538	4.52691	4.56657	4.60515	4.64334
465.5	4.22317	4.26850	4.33948	4.39645	4.44573	4.49029	4.53185	4.57152	4.61013	4.64834
466.0	4.22794	4.27329	4.34431	4.40131	4.45062	4.49529	4.53679	4.57648	4.61511	4.65334
466.5	4.23270	4.27808	4.34914	4.40618	4.45550	4.50012	4.54172	4.58144	4.62009	4.65834
467.0	4.23746	4.28287	4.35397	4.41104	4.46039	4.50503	4.54666	4.58640	4.62507	4.66334
467.5	4.24223	4.28766	4.35880	4.41590	4.46528	4.50995	4.55160	4.59136	4.63005	4.66834
468.0	4.24699	4.29245	4.36363	4.42076	4.47017	4.51486	4.55654	4.59632	4.63503	4.67334
468.5	4.25176	4.29724	4.36846	4.42562	4.47506	4.51977	4.56147	4.60128	4.64001	4.67834
469.0	4.25652	4.30203	4.37329	4.43049	4.47995	4.52469	4.56641	4.60623	4.64499	4.68334
469.5	4.26129	4.30682	4.37812	4.43573	4.48524	4.52998	4.57171	4.61159	4.65047	4.68834
470.0	4.26605	4.31161	4.38295	4.44102	4.49057	4.53532	4.57706	4.61695	4.65595	4.69334
470.5	4.27082	4.31641	4.38778	4.44633	4.49592	4.54073	4.58248	4.62237	4.66148	4.69834
471.0	4.27558	4.32120	4.39262	4.45167	4.50130	4.54615	4.58792	4.62782	4.66703	4.70334
471.5	4.28035	4.32599	4.39745	4.45694	4.50661	4.55153	4.59332	4.63423	4.67355	4.70834
472.0	4.28511	4.33078	4.40228	4.46273	4.51242	4.55741	4.59921	4.63913	4.67856	4.71334
472.5	4.28988	4.33557	4.40711	4.46913	4.51884	4.56390	4.60571	4.64566	4.68523	4.71834
473.0	4.29465	4.34036	4.41194	4.47399	4.52376	4.56884	4.61066	4.65073	4.69056	4.72334
473.5	4.29941	4.34515	4.41677	4.47884	4.52863	4.57373	4.61550	4.65566	4.69573	4.72834
474.0	4.30418	4.34995	4.42160	4.48363	4.53253	4.57766	4.61833	4.65860	4.69877	4.73334
474.5	4.30894	4.35474	4.42643	4.48844	4.53734	4.58253	4.62203	4.66240	4.70247	4.73834
475.0	4.31371	4.35953	4.43127	4.49333	4.54203	4.58726	4.62566	4.66613	4.70744	4.74333
475.5	4.31848	4.36433	4.43603	4.49813	4.54673	4.59200	4.63050	4.67107	4.71243	4.74833
476.0	4.32324	4.36911	4.44093	4.50303	4.55273	4.59803	4.63653	4.67720	4.71740	4.75333
476.5	4.32801	4.37391	4.44576	4.50833	4.55803	4.60333	4.64183	4.68260	4.72246	4.75833
477.0	4.33278	4.37870	4.45059	4.51160	4.56133	4.60663	4.64513	4.68590	4.72746	4.76333
477.5	4.33754	4.38349	4.45543	4.51633	4.56603	4.61133	4.64983	4.69060	4.73246	4.76833
478.0	4.34231	4.38828	4.46026	4.52123	4.57093	4.61623	4.65473	4.69550	4.73746	4.77333
478.5	4.34708	4.39308	4.46509	4.52613	4.57583	4.62113	4.65963	4.70043	4.74146	4.77833
479.0	4.35184	4.39787	4.46992	4.53113	4.58083	4.62643	4.66493	4.70543	4.74646	4.78333
479.5	4.35661	4.40266	4.47476	4.53633	4.58603	4.63173	4.67023	4.71003	4.75106	4.78833
480.0	4.36138	4.40745	4.47959	4.54153	4.59123	4.63703	4.67553	4.71533	4.75646	4.79333
480.5	4.36615	4.41225	4.48442	4.54663	4.59633	4.64213	4.68063	4.72023	4.76176	4.79833
481.0	4.37091	4.41704	4.48925	4.55183	4.60153	4.64733	4.68583	4.72523	4.76676	4.80333
481.5	4.37568	4.42183	4.49409	4.55703	4.60673	4.65253	4.69103	4.73023	4.77176	4.80833
482.0	4.38045	4.42663	4.49892	4.56223	4.61153	4.65733	4.69583	4.73517	4.77676	4.81333
482.5	4.38522	4.43142	4.50375	4.56783	4.61733	4.66313	4.70163	4.74017	4.78176	4.81833
483.0	4.38999	4.43621	4.50859	4.57303	4.62183	4.66763	4.70593	4.74447	4.78606	4.82333
483.5	4.39475	4.44101	4.51342	4.57783	4.62603	4.67183	4.71013	4.74867	4.79026	4.82833
484.0	4.39952	4.44580	4.51825	4.58273	4.63013	4.67603	4.71433	4.75287	4.79446	4.83333
484.5	4.40429	4.45056	4.52209	4.58763	4.63423	4.68013	4.71843	4.75697	4.79856	4.83833
485.0	4.40906	4.45533	4.52686	4.59353	4.64233	4.68823	4.72653	4.76507	4.80666	4.84333
485.5	4.41383	4.46010	4.53163	4.59833	4.64643	4.69233	4.73063	4.76917	4.81076	4.84833
486.0	4.41860	4.46487	4.53640	4.60303	4.65113	4.69703	4.73533	4.77387	4.81546	4.85333
486.5	4.42337	4.46964	4.54117	4.60813	4.65623	4.70213	4.74043	4.77897	4.81956	4.85833
487.0	4.42814	4.47441	4.54594	4.61323	4.66133	4.70723	4.74553	4.78407	4.82466	4.86333

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and r

r/Q	.45000	.40000	.35000	.30000	.25000	.20000	.15000	.10000	.075000
1.0	.510321	.570652	.634570	.707419	.781233	.856237	.931408	1.000000	.075000
1.1	.603337	.669665	.737600	.812244	.887643	.961190	1.000000	.291647	.339504
1.2	.698204	.770163	.844210	.919950	1.000000	1.000000	1.000000	.312101	.361267
1.3	.794480	.871749	.951596	1.040538	1.137611	1.240000	1.340000	.320339	.382399
1.4	.891844	.974142	1.063939	1.162013	1.268301	1.382129	1.500000	.351426	.482984
1.5	.990057	1.07714	1.16978	1.26979	1.37810	1.49392	1.610000	.370426	.523089
1.6	1.08894	1.18058	1.27524	1.38254	1.49392	1.610000	1.730000	.407343	.542069
1.8	1.28821	1.38841	1.49392	1.610000	1.730000	1.850000	1.970000	.425332	.581029
1.9	1.38840	1.49392	1.610000	1.730000	1.850000	1.970000	2.100000	.443049	.619681
2.0	1.48880	1.59702	1.70994	1.82000	1.93420	2.05000	2.17000	.460517	.651085
2.1	1.58959	1.70149	1.81471	1.92190	2.03624	2.15000	2.27000	.477756	.676170
2.2	1.69049	1.80604	1.91667	2.02933	2.14627	2.26000	2.38000	.494791	.694051
2.3	1.79155	1.91063	2.01846	2.12585	2.24169	2.35000	2.46000	.511630	.707116
2.4	1.89274	2.01526	2.12007	2.21749	2.33162	2.44000	2.57000	.528292	.716181
2.5	1.99404	2.11990	2.22150	2.30333	2.41502	2.52000	2.68000	.544788	.721481
2.6	2.09543	2.22454	2.32277	2.38682	2.50000	2.60000	2.79000	.561130	.723565
2.7	2.19689	2.32918	2.42366	2.47100	2.57532	2.67000	2.88000	.577327	.722000
2.8	2.29841	2.43381	2.52249	2.55768	2.64695	2.74000	2.97000	.593399	.697300
2.9	2.39999	2.53842	2.62556	2.64150	2.71795	2.81000	3.06000	.609324	.673949
3.0	2.50161	2.64301	2.72617	2.73667	2.80034	2.89000	3.15000	.625139	.650464
3.1	2.60327	2.74757	2.82662	2.82883	2.90000	2.97000	3.24000	.640841	.706853
3.2	2.70495	2.85210	2.92594	2.91938	3.00000	3.06000	3.33000	.656370	.723122
3.3	2.80666	2.95660	3.02197	3.01256	3.09625	3.15000	3.42000	.671931	.739270
3.4	2.90839	3.06107	3.11774	3.10437	3.18255	3.24000	3.51000	.687329	.755326
3.5	3.01013	3.16550	3.21303	3.19583	3.26880	3.32000	3.60000	.702636	.771272
3.6	3.11188	3.26990	3.30758	3.28696	3.35500	3.38000	3.69000	.717856	.787121
3.7	3.21365	3.37426	3.39143	3.37177	3.44073	3.44000	3.78000	.732994	.802877
3.8	3.31542	3.47859	3.48540	3.45328	3.51329	3.51000	3.87000	.748052	.818544
3.9	3.41719	3.58288	3.57834	3.53950	3.58597	3.58000	3.96000	.763034	.834127
4.0	3.51897	3.68713	3.67163	3.61943	3.65527	3.59000	4.05000	.777944	.849628
4.1	3.62075	3.79135	3.76580	3.69810	3.71071	3.61000	4.14000	.792785	.865052
4.2	3.72252	3.89554	3.86004	3.78150	3.76581	3.63000	4.23000	.807559	.880402
4.3	3.82430	3.99968	3.92482	3.86466	3.82050	3.65000	4.32000	.822268	.895679
4.4	3.92607	4.10380	4.00000	3.94868	3.87577	3.67000	4.41000	.836917	.910888
4.5	4.02784	4.20792	4.07500	4.03271	3.93045	3.69000	4.50000	.851506	.926031
4.6	4.12961	4.31192	4.14911	4.11681	3.98527	3.71000	4.59000	.866038	.941110
4.7	4.23137	4.41593	4.22309	4.20165	4.04000	3.73000	4.68000	.880515	.956127
4.8	4.33312	4.51990	4.30423	4.28650	4.09491	3.75000	4.77000	.894940	.971085
4.9	4.43487	4.62385	4.38856	4.37136	4.14969	3.77000	4.86000	.909312	.985986
5.0	4.53661	4.72776	4.47276	4.45623	4.20443	3.79000	4.95000	.923636	1.000882

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$	.475000	.450000	.400000	.350000	.300000	.250000	.150000	.100000	.075000
5.1	.463835	.463164	.524009	.568579	.616187	.674620	.741742	.824985	.937911
5.2	.474007	.493548	.534824	.579837	.629912	.687047	.754526	.838413	.952140
5.3	.484179	.503930	.545310	.591083	.641260	.698531	.767250	.852104	.966324
5.4	.494351	.514309	.555830	.602317	.653301	.711433	.780006	.865160	.980469
5.5	.504521	.524684	.566422	.617338	.669494	.728592	.797204	.882482	.997429
5.6	.514691	.534957	.576906	.627748	.680611	.740370	.809375	.894770	.100662
5.7	.524860	.545227	.587364	.638202	.691620	.751334	.820026	.905026	.102266
5.8	.535028	.555494	.597681	.649734	.703597	.763251	.831620	.916251	.103662
5.9	.545195	.565758	.608418	.661101	.715158	.774446	.842335	.925446	.105056
6.0	.555362	.575920	.618601	.672314	.727114	.786000	.853608	.936461	.106450
6.1	.565528	.586079	.628827	.686032	.741695	.799120	.866354	.949746	.107833
6.2	.575692	.597235	.638871	.698178	.754625	.811420	.878654	.962146	.109217
6.3	.585856	.607589	.648910	.709294	.764837	.821460	.888694	.972138	.110597
6.4	.596019	.617940	.659043	.719404	.775358	.831832	.899062	.981499	.111974
6.5	.606182	.628289	.669281	.728518	.784806	.841102	.908332	.990837	.113347
6.6	.616343	.638635	.679520	.737626	.793201	.849302	.916532	.999102	.114718
6.7	.626504	.648979	.690256	.745735	.801394	.859401	.926762	.100230	.116085
6.8	.636664	.659321	.701501	.753846	.810396	.869401	.937992	.101360	.117450
6.9	.646823	.669660	.711762	.761958	.820396	.879401	.948182	.102485	.118812
7.0	.656981	.679937	.722021	.770061	.829343	.888343	.959325	.103610	.120170
7.1	.667138	.690332	.733015	.779178	.838600	.897301	.968669	.104735	.121526
7.2	.677295	.700664	.746705	.791236	.857846	.916301	.988350	.105860	.122880
7.3	.687451	.710995	.755389	.800387	.867268	.925501	.998302	.106985	.124230
7.4	.697606	.721323	.765069	.809440	.876822	.935501	.100260	.108110	.125578
7.5	.707760	.731649	.774744	.818501	.886520	.944601	.101487	.109235	.126924
7.6	.717914	.741974	.784815	.827561	.895924	.953701	.102712	.110360	.128267
7.7	.728066	.752296	.803081	.836594	.905319	.964301	.103937	.111485	.129608
7.8	.738218	.762616	.813742	.845628	.914704	.975301	.105162	.112610	.130946
7.9	.748370	.772934	.824400	.854660	.924100	.986301	.106387	.113735	.132282
8.0	.758522	.783251	.835053	.864693	.933446	.996301	.107612	.114860	.133616
8.1	.768674	.793565	.845701	.874301	.943001	.100363	.111519	.121539	.134947
8.2	.778826	.803878	.856346	.884917	.951501	.101538	.112736	.122806	.136276
8.3	.788977	.814189	.866987	.895401	.960001	.102712	.113933	.124071	.137603
8.4	.799128	.824498	.877623	.905874	.968501	.103887	.115130	.125336	.138929
8.5	.809279	.834805	.888256	.916347	.977001	.105062	.116327	.126596	.140251
8.6	.819430	.845111	.898885	.926805	.985501	.106237	.117524	.127856	.141572
8.7	.829581	.855415	.909510	.936763	.994001	.107412	.118721	.129115	.142891
8.8	.839732	.865717	.920132	.947814	.100306	.111556	.120008	.130371	.144208
8.9	.849883	.876018	.930750	.959660	.101487	.112752	.121215	.131627	.145523
9.0	.859934	.886317	.941364	.970060	.102668	.113948	.122421	.132880	.146837
9.1	.870085	.896614	.951975	.981153	.103863	.115143	.123626	.134133	.148148
9.2	.880236	.906910	.962582	.992246	.105062	.116338	.124830	.135383	.149457
9.3	.890387	.917204	.973186	.100339	.106237	.117532	.126033	.136633	.150765
9.4	.900538	.927497	.983781	.101519	.107412	.118726	.127236	.137883	.152071
9.5	.910689	.937788	.994364	.102700	.108587	.119921	.128439	.139132	.153375
9.6	.920840	.948077	.100498	.103887	.109763	.121115	.129642	.140382	.154678
9.7	.930991	.958366	.101657	.105062	.110958	.122310	.130845	.141632	.155982
9.8	.941142	.968652	.102816	.106237	.112153	.123505	.132048	.142882	.157286
9.9	.951293	.978938	.103975	.107412	.113347	.124700	.133251	.144132	.158590
10.0	.961444	.989222	.105134	.108587	.114540	.125895	.134454	.145382	.159894

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and p

$v \setminus Q$	.475000	.450000	.430000	.350000	.300000	.250000	.150000	.100000	.075000
10.1	914520 01	999534 01	105790 02	112060 02	118328 02	126644 02	146578 02	161166 02	171844 02
10.2	981656 01	100979 02	106848 02	113148 02	120040 02	127796 02	147815 02	162459 02	172373 02
10.3	991792 01	102007 02	107905 02	114235 02	121167 02	128952 02	149051 02	163751 02	173699 02
10.4	100193 02	103034 02	108962 02	115323 02	122286 02	130105 02	150286 02	165041 02	175025 02
10.5	101206 02	104062 02	110019 02	116409 02	123604 02	131257 02	151520 02	166329 02	176340 02
10.6	102219 02	105090 02	111075 02	117495 02	124922 02	132409 02	152752 02	167616 02	177670 02
10.7	103233 02	106117 02	112131 02	118561 02	126239 02	133559 02	153904 02	168902 02	178990 02
10.8	104246 02	107144 02	113187 02	119627 02	127555 02	134709 02	155214 02	170186 02	180309 02
10.9	105259 02	108172 02	114243 02	120752 02	128871 02	135858 02	156443 02	171469 02	181626 02
11.0	106272 02	109199 02	115298 02	121835 02	129987 02	137007 02	157671 02	172750 02	182942 02
11.1	107285 02	110226 02	116353 02	122920 02	131011 02	138155 02	158898 02	174030 02	184256 02
11.2	108298 02	111253 02	117408 02	124004 02	132116 02	139302 02	160124 02	175309 02	185569 02
11.3	109311 02	112279 02	118463 02	125088 02	133229 02	140448 02	161340 02	176586 02	186880 02
11.4	110324 02	113306 02	119517 02	126171 02	134343 02	141594 02	162572 02	177863 02	188190 02
11.5	111337 02	114332 02	120571 02	127253 02	135455 02	142739 02	163795 02	179137 02	189499 02
11.6	112350 02	115359 02	121625 02	128336 02	136567 02	143883 02	165016 02	180411 02	190805 02
11.7	113363 02	116385 02	122679 02	129417 02	137679 02	145027 02	166237 02	181684 02	192111 02
11.8	114376 02	117411 02	123732 02	130499 02	138790 02	146170 02	167457 02	182955 02	193415 02
11.9	115388 02	118437 02	124785 02	131580 02	139901 02	147312 02	168675 02	184225 02	194718 02
12.0	116401 02	119463 02	125838 02	132661 02	141011 02	148454 02	169893 02	185493 02	196020 02
12.1	117413 02	120489 02	126891 02	133741 02	142121 02	149595 02	171110 02	186761 02	197320 02
12.2	118426 02	121515 02	127944 02	134822 02	143230 02	150736 02	172326 02	188028 02	198619 02
12.3	119439 02	122540 02	128996 02	135901 02	144339 02	151876 02	173541 02	189293 02	199917 02
12.4	120451 02	123566 02	130048 02	136981 02	145447 02	153015 02	174755 02	190557 02	201213 02
12.5	121463 02	124591 02	131100 02	138060 02	146555 02	154154 02	175968 02	191820 02	202508 02
12.6	122476 02	125617 02	132151 02	139139 02	147662 02	155292 02	177180 02	193082 02	203802 02
12.7	123488 02	126642 02	133203 02	140217 02	148769 02	156430 02	178391 02	194343 02	205095 02
12.8	124500 02	127667 02	134254 02	141295 02	149876 02	157567 02	179601 02	195603 02	206386 02
12.9	125513 02	128692 02	135305 02	142373 02	150982 02	158703 02	180811 02	196862 02	207676 02
13.0	126525 02	129717 02	136356 02	143451 02	152187 02	159839 02	182020 02	198119 02	208966 02
13.2	128549 02	131767 02	138457 02	145605 02	153397 02	162109 02	184435 02	200632 02	211540 02
13.4	130573 02	133816 02	140557 02	147758 02	155506 02	164377 02	186846 02	203140 02	214111 02
13.6	132597 02	135865 02	142656 02	149909 02	157612 02	166843 02	189255 02	205644 02	216676 02
13.8	134621 02	137913 02	144755 02	152060 02	160017 02	168907 02	191660 02	208145 02	219238 02
14.0	136644 02	139961 02	146853 02	154209 02	162221 02	171169 02	194062 02	210641 02	221795 02
14.2	138668 02	142009 02	148950 02	156357 02	164423 02	173429 02	196462 02	213134 02	224348 02
14.4	140691 02	144056 02	151047 02	158505 02	166624 02	175687 02	198858 02	215624 02	226898 02
14.6	142714 02	146104 02	153143 02	160651 02	168823 02	177944 02	201251 02	218110 02	229443 02
14.8	144737 02	148150 02	155238 02	162796 02	171021 02	180198 02	203642 02	220592 02	231984 02
15.0	146760 02	150197 02	157332 02	164940 02	173217 02	182451 02	205030 02	223071 02	234522 02
15.2	148782 02	152243 02	159426 02	167023 02	175412 02	184702 02	208415 02	225547 02	237056 02
15.4	150805 02	154289 02	161519 02	169225 02	177606 02	186951 02	210798 02	228020 02	239586 02
15.6	152827 02	156335 02	163612 02	171367 02	179798 02	189190 02	213178 02	230489 02	242112 02
15.8	154849 02	158380 02	165704 02	173507 02	181989 02	191444 02	215555 02	232955 02	244635 02
16.0	156872 02	160425 02	167795 02	175646 02	184789 02	193689 02	217931 02	235418 02	247155 02
16.2	158894 02	162470 02	169886 02	177785 02	186568 02	195931 02	220301 02	237878 02	249672 02
16.4	160915 02	164514 02	171976 02	179922 02	188355 02	198172 02	222673 02	240336 02	252185 02
16.6	162937 02	166558 02	174066 02	182059 02	190741 02	200412 02	225041 02	242790 02	254695 02
16.8	164959 02	168602 02	176155 02	184195 02	192826 02	202650 02	227407 02	245242 02	257201 02
17.0	166980 02	170646 02	178244 02	186330 02	195110 02	204887 02	229770 02	247690 02	259705 02

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$	.475000	.450000	.400000	.350000	.300000	.250000	.200000	.150000	.100000	.075000
27.50	.272973	.277655	.287314	.297530	.308552	.320747	.334694	.351446	.373290	.387825
27.75	.275495	.281198	.289900	.300161	.311231	.323476	.337460	.354299	.376143	.390614
28.00	.278016	.284740	.294486	.305791	.317605	.330366	.344205	.361050	.382894	.397381
28.25	.280537	.288282	.299072	.311521	.324386	.338193	.352880	.369769	.387662	.396786
28.50	.283057	.291824	.303762	.316851	.330592	.345399	.361302	.379347	.398462	.399768
28.75	.285578	.295366	.308441	.322799	.337197	.352612	.369194	.387979	.407949	.402749
29.00	.288099	.298908	.313025	.328308	.343612	.359394	.376702	.395838	.416875	.405727
29.25	.290619	.299549	.315549	.331595	.347485	.363833	.381897	.399735	.420036	.408703
29.50	.293140	.297991	.318093	.334595	.350959	.367285	.385172	.402223	.423492	.411677
29.75	.295660	.299532	.320576	.337619	.354000	.370727	.388272	.405727	.427064	.414649
30.00	.298181	.303073	.323159	.340681	.357082	.374997	.393202	.410250	.430560	.417619
30.25	.300701	.305613	.325741	.343800	.360182	.378177	.396476	.414770	.434577	.420587
30.50	.303221	.308154	.328323	.346965	.363302	.381336	.399849	.419286	.438592	.423553
30.75	.305741	.310695	.330905	.350199	.366431	.384514	.403281	.423800	.442606	.426517
31.00	.308261	.313235	.333486	.353144	.369581	.387712	.406359	.428800	.446619	.429479
31.25	.310781	.315775	.336067	.356192	.372792	.390877	.409476	.433800	.450632	.432440
31.50	.313301	.318315	.338648	.359302	.375917	.394012	.412592	.438800	.454646	.435398
31.75	.315820	.320855	.341229	.362482	.379042	.397166	.415702	.443800	.458660	.438355
32.00	.318340	.323394	.343809	.365648	.382182	.399730	.418812	.448800	.462674	.441309
32.25	.320860	.325934	.346380	.368800	.385315	.402842	.421927	.453800	.466688	.444262
32.50	.323379	.328473	.348968	.371979	.388454	.405954	.425042	.458800	.470713	.447213
32.75	.325899	.331012	.351547	.375167	.391643	.409066	.428166	.463800	.474727	.450163
33.00	.328418	.333551	.354126	.378387	.394339	.412182	.431286	.468800	.478741	.453110
33.25	.330937	.336090	.356704	.381642	.397022	.415302	.434406	.473800	.482755	.456056
33.50	.333457	.338629	.359283	.384926	.400112	.418417	.437526	.478800	.486769	.459000
33.75	.335976	.341167	.361861	.388245	.403242	.421532	.440646	.483800	.490783	.461943
34.00	.338495	.343706	.364438	.391592	.406382	.424647	.443776	.488800	.494797	.464884
34.25	.341014	.346244	.367016	.394960	.409532	.427762	.446906	.493800	.498811	.467823
34.50	.343533	.348782	.369593	.398380	.412682	.430877	.450036	.498800	.502825	.470761
34.75	.346052	.351320	.372170	.401842	.415833	.434012	.453166	.503800	.506839	.473697
35.00	.348571	.353858	.374746	.405231	.418991	.437147	.456296	.508800	.510853	.476631
35.25	.351090	.356396	.377322	.408647	.422149	.440282	.459426	.513800	.514867	.479564
35.50	.353609	.358933	.379898	.411463	.425307	.443417	.462556	.518800	.519881	.482495
35.75	.356127	.361471	.382474	.414288	.428472	.446552	.465626	.523800	.520895	.485425
36.00	.358645	.364008	.385049	.417112	.431642	.449687	.468696	.528800	.523909	.488353
36.25	.361164	.366545	.387625	.420307	.434817	.452822	.471766	.533800	.526923	.491280
36.50	.363682	.369083	.390200	.423502	.437992	.455957	.474836	.538800	.529937	.494205
36.75	.366201	.371620	.392774	.426697	.441167	.459092	.477906	.543800	.532951	.497129
37.00	.368719	.374156	.395348	.429892	.444342	.462227	.480976	.548800	.535965	.500051
37.25	.371237	.376693	.397923	.433087	.447517	.465357	.484046	.553800	.538979	.502972
37.50	.373755	.379230	.390496	.436282	.450692	.468482	.487120	.558800	.541993	.505891
37.75	.376273	.381766	.393070	.439477	.453877	.471617	.490194	.563800	.545007	.508800
38.00	.378791	.384312	.395643	.442672	.457072	.474762	.493268	.568800	.548021	.511726
38.25	.381309	.386839	.398218	.445867	.460247	.477907	.496342	.573800	.551035	.514641
38.50	.383827	.389375	.400792	.449062	.463422	.481052	.499416	.578800	.554049	.517555
38.75	.386345	.391911	.403367	.452257	.466597	.484207	.502490	.583800	.557063	.520467
39.00	.388863	.394446	.405932	.455452	.469772	.487357	.505564	.588800	.560077	.523378
39.25	.391381	.396981	.408507	.458647	.472947	.490507	.508638	.593800	.563091	.526288
39.50	.393899	.399520	.411082	.461842	.476142	.493657	.511712	.598800	.566105	.529197
39.75	.396417	.402069	.413657	.465037	.479337	.496807	.514786	.603800	.569119	.532104

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

ν	.675000	.680000	.685000	.690000	.695000	.700000	.705000	.710000	.715000	.720000	.725000	.730000	.735000	.740000	.745000	.750000	.755000	.760000	.765000	.770000	.775000	.780000	.785000	.790000	.795000	.800000	.805000	.810000	.815000	.820000	.825000	.830000	.835000	.840000	.845000	.850000	.855000	.860000	.865000	.870000	.875000	.880000	.885000	.890000	.895000	.900000	.905000	.910000	.915000	.920000	.925000	.930000	.935000	.940000	.945000	.950000	.955000	.960000	.965000	.970000	.975000	.980000	.985000	.990000	.995000	1.000000										
62.5	.625139 02	.630139 02	.635139 02	.640139 02	.645139 02	.650139 02	.655139 02	.660139 02	.665139 02	.670139 02	.675139 02	.680139 02	.685139 02	.690139 02	.695139 02	.700139 02	.705139 02	.710139 02	.715139 02	.720139 02	.725139 02	.730139 02	.735139 02	.740139 02	.745139 02	.750139 02	.755139 02	.760139 02	.765139 02	.770139 02	.775139 02	.780139 02	.785139 02	.790139 02	.795139 02	.800139 02	.805139 02	.810139 02	.815139 02	.820139 02	.825139 02	.830139 02	.835139 02	.840139 02	.845139 02	.850139 02	.855139 02	.860139 02	.865139 02	.870139 02	.875139 02	.880139 02	.885139 02	.890139 02	.895139 02	.900139 02	.905139 02	.910139 02	.915139 02	.920139 02	.925139 02	.930139 02	.935139 02	.940139 02	.945139 02	.950139 02	.955139 02	.960139 02	.965139 02	.970139 02	.975139 02	.980139 02	.985139 02	.990139 02	.995139 02	1.000139 02

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$.475000	.490000	.500000	.500000	.510000	.520000	.530000	.540000	.550000	.560000	.570000	.580000	.590000	.600000	.610000	.620000	.630000	.640000	.650000	.660000	.670000	.680000	.690000	.700000	.710000	.720000	.730000	.740000	.750000	.760000	.770000	.780000	.790000	.800000	.810000	.820000	.830000	.840000	.850000	.860000	.870000	.880000	.890000	.900000																																																																																																																																																																																																																																																																																																																										
137.5	1.37873 03	1.39322 03	1.40666 03	1.41865 03	1.42975 03	1.44019 03	1.44999 03	1.45929 03	1.46812 03	1.47652 03	1.48452 03	1.49215 03	1.49946 03	1.50649 03	1.51328 03	1.51987 03	1.52630 03	1.53252 03	1.53858 03	1.54443 03	1.55012 03	1.55569 03	1.56118 03	1.56662 03	1.57196 03	1.57722 03	1.58244 03	1.58757 03	1.59265 03	1.59762 03	1.60253 03	1.60733 03	1.61207 03	1.61679 03	1.62144 03	1.62607 03	1.63064 03	1.63519 03	1.63974 03	1.64425 03	1.64876 03	1.65324 03	1.65773 03	1.66221 03	1.66670 03	1.67117 03	1.67567 03	1.68017 03	1.68468 03	1.68919 03	1.69372 03	1.69824 03	1.70278 03	1.70733 03	1.71189 03	1.71646 03	1.72105 03	1.72565 03	1.73027 03	1.73491 03	1.73957 03	1.74424 03	1.74893 03	1.75364 03	1.75837 03	1.76311 03	1.76787 03	1.77264 03	1.77743 03	1.78224 03	1.78706 03	1.79190 03	1.79676 03	1.80163 03	1.80652 03	1.81143 03	1.81636 03	1.82131 03	1.82627 03	1.83125 03	1.83625 03	1.84127 03	1.84631 03	1.85137 03	1.85644 03	1.86153 03	1.86664 03	1.87177 03	1.87692 03	1.88209 03	1.88728 03	1.89248 03	1.89770 03	1.90294 03	1.90820 03	1.91347 03	1.91876 03	1.92407 03	1.92940 03	1.93475 03	1.94012 03	1.94551 03	1.95092 03	1.95635 03	1.96180 03	1.96727 03	1.97277 03	1.97829 03	1.98383 03	1.98939 03	1.99497 03	2.00057 03	2.00619 03	2.01184 03	2.01750 03	2.02319 03	2.02890 03	2.03463 03	2.04038 03	2.04615 03	2.05195 03	2.05777 03	2.06361 03	2.06947 03	2.07535 03	2.08125 03	2.08718 03	2.09313 03	2.09910 03	2.10509 03	2.11110 03	2.11713 03	2.12319 03	2.12927 03	2.13537 03	2.14148 03	2.14761 03	2.15376 03	2.15993 03	2.16613 03	2.17235 03	2.17859 03	2.18485 03	2.19113 03	2.19743 03	2.20375 03	2.21009 03	2.21645 03	2.22283 03	2.22923 03	2.23565 03	2.24209 03	2.24855 03	2.25503 03	2.26153 03	2.26805 03	2.27459 03	2.28115 03	2.28773 03	2.29433 03	2.30095 03	2.30759 03	2.31425 03	2.32093 03	2.32763 03	2.33435 03	2.34109 03	2.34785 03	2.35463 03	2.36143 03	2.36825 03	2.37509 03	2.38195 03	2.38883 03	2.39573 03	2.40265 03	2.40959 03	2.41655 03	2.42353 03	2.43053 03	2.43755 03	2.44459 03	2.45165 03	2.45873 03	2.46583 03	2.47294 03	2.48007 03	2.48722 03	2.49439 03	2.50158 03	2.50879 03	2.51602 03	2.52327 03	2.53054 03	2.53783 03	2.54514 03	2.55247 03	2.55982 03	2.56719 03	2.57458 03	2.58199 03	2.58942 03	2.59687 03	2.60434 03	2.61182 03	2.61932 03	2.62684 03	2.63438 03	2.64194 03	2.64951 03	2.65710 03	2.66471 03	2.67234 03	2.68000 03	2.68767 03	2.69536 03	2.70307 03	2.71080 03	2.71855 03	2.72632 03	2.73411 03	2.74192 03	2.74975 03	2.75760 03	2.76547 03	2.77336 03	2.78127 03	2.78920 03	2.79715 03	2.80512 03	2.81311 03	2.82112 03	2.82915 03	2.83720 03	2.84527 03	2.85336 03	2.86147 03	2.86960 03	2.87775 03	2.88592 03	2.89411 03	2.90232 03	2.91055 03	2.91880 03	2.92707 03	2.93536 03	2.94367 03	2.95200 03	2.96035 03	2.96872 03	2.97711 03	2.98552 03	2.99395 03	3.00240 03	3.01087 03	3.01936 03	3.02787 03	3.03640 03	3.04495 03	3.05352 03	3.06211 03	3.07072 03	3.07935 03	3.08800 03	3.09667 03	3.10536 03	3.11407 03	3.12280 03	3.13155 03	3.14032 03	3.14911 03	3.15792 03	3.16675 03	3.17560 03	3.18447 03	3.19336 03	3.20227 03	3.21120 03	3.22015 03	3.22912 03	3.23811 03	3.24712 03	3.25615 03	3.26520 03	3.27427 03	3.28336 03	3.29247 03	3.30160 03	3.31075 03	3.31992 03	3.32911 03	3.33832 03	3.34755 03	3.35680 03	3.36607 03	3.37536 03	3.38467 03	3.39400 03	3.40335 03	3.41272 03	3.42211 03	3.43152 03	3.44095 03	3.45040 03	3.45987 03	3.46936 03	3.47887 03	3.48840 03	3.49795 03	3.50752 03	3.51711 03	3.52672 03	3.53635 03	3.54600 03	3.55567 03	3.56536 03	3.57507 03	3.58480 03	3.59455 03	3.60432 03	3.61411 03	3.62392 03	3.63375 03	3.64360 03	3.65347 03	3.66336 03	3.67327 03	3.68320 03	3.69315 03	3.70312 03	3.71311 03	3.72312 03	3.73315 03	3.74320 03	3.75327 03	3.76336 03	3.77347 03	3.78360 03	3.79375 03	3.80392 03	3.81411 03	3.82432 03	3.83455 03	3.84480 03	3.85507 03	3.86536 03	3.87567 03	3.88600 03	3.89635 03	3.90672 03	3.91711 03	3.92752 03	3.93795 03	3.94840 03	3.95887 03	3.96936 03	3.97987 03	4.00000 03

Percentage Points of the χ^2 Distribution
A Table of χ^2 and Cumulative P

χ^2	P	10.0000	15.0000	20.0000	25.0000	30.0000	40.0000	50.0000	60.0000	70.0000	80.0000	100.0000	150.0000	200.0000	300.0000	400.0000	500.0000		
0.2	0.6219	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	
1.6	0.2051	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261	21.0261

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

ν	0.75000	0.80000	0.85000	0.90000	0.95000	1.00000	1.10000	1.20000	1.50000	1.60000	1.70000	1.80000
32.5	31.242 02	31.952 03	32.522 03	32.952 03	33.252 03	33.452 03	33.552 03	33.652 03	33.752 03	33.852 03	33.952 03	34.052 03
32.6	31.323 03	32.033 03	32.603 03	33.033 03	33.333 03	33.533 03	33.633 03	33.733 03	33.833 03	33.933 03	34.033 03	34.133 03
32.7	31.404 03	32.114 03	32.684 03	33.114 03	33.414 03	33.614 03	33.714 03	33.814 03	33.914 03	34.014 03	34.114 03	34.214 03
32.8	31.485 03	32.195 03	32.765 03	33.195 03	33.495 03	33.695 03	33.795 03	33.895 03	33.995 03	34.095 03	34.195 03	34.295 03
32.9	31.566 03	32.276 03	32.846 03	33.276 03	33.576 03	33.776 03	33.876 03	33.976 03	34.076 03	34.176 03	34.276 03	34.376 03
33.0	31.647 03	32.357 03	32.927 03	33.357 03	33.657 03	33.857 03	33.957 03	34.057 03	34.157 03	34.257 03	34.357 03	34.457 03
33.1	31.728 03	32.438 03	33.008 03	33.438 03	33.738 03	33.938 03	34.038 03	34.138 03	34.238 03	34.338 03	34.438 03	34.538 03
33.2	31.809 03	32.519 03	33.089 03	33.519 03	33.819 03	34.019 03	34.119 03	34.219 03	34.319 03	34.419 03	34.519 03	34.619 03
33.3	31.890 03	32.600 03	33.170 03	33.600 03	33.900 03	34.100 03	34.200 03	34.300 03	34.400 03	34.500 03	34.600 03	34.700 03
33.4	31.971 03	32.681 03	33.251 03	33.681 03	33.981 03	34.181 03	34.281 03	34.381 03	34.481 03	34.581 03	34.681 03	34.781 03
33.5	32.052 03	32.762 03	33.332 03	33.762 03	34.062 03	34.262 03	34.362 03	34.462 03	34.562 03	34.662 03	34.762 03	34.862 03
33.6	32.133 03	32.843 03	33.413 03	33.843 03	34.143 03	34.343 03	34.443 03	34.543 03	34.643 03	34.743 03	34.843 03	34.943 03
33.7	32.214 03	32.924 03	33.494 03	33.924 03	34.224 03	34.424 03	34.524 03	34.624 03	34.724 03	34.824 03	34.924 03	35.024 03
33.8	32.295 03	33.005 03	33.575 03	34.005 03	34.305 03	34.505 03	34.605 03	34.705 03	34.805 03	34.905 03	35.005 03	35.105 03
33.9	32.376 03	33.086 03	33.656 03	34.086 03	34.386 03	34.586 03	34.686 03	34.786 03	34.886 03	34.986 03	35.086 03	35.186 03
34.0	32.457 03	33.167 03	33.737 03	34.167 03	34.467 03	34.667 03	34.767 03	34.867 03	34.967 03	35.067 03	35.167 03	35.267 03
34.1	32.538 03	33.248 03	33.818 03	34.248 03	34.548 03	34.748 03	34.848 03	34.948 03	35.048 03	35.148 03	35.248 03	35.348 03
34.2	32.619 03	33.329 03	33.899 03	34.329 03	34.629 03	34.829 03	34.929 03	35.029 03	35.129 03	35.229 03	35.329 03	35.429 03
34.3	32.700 03	33.410 03	33.980 03	34.410 03	34.710 03	34.910 03	35.010 03	35.110 03	35.210 03	35.310 03	35.410 03	35.510 03
34.4	32.781 03	33.491 03	34.061 03	34.491 03	34.791 03	34.991 03	35.091 03	35.191 03	35.291 03	35.391 03	35.491 03	35.591 03
34.5	32.862 03	33.572 03	34.142 03	34.572 03	34.872 03	35.072 03	35.172 03	35.272 03	35.372 03	35.472 03	35.572 03	35.672 03
34.6	32.943 03	33.653 03	34.223 03	34.653 03	34.953 03	35.153 03	35.253 03	35.353 03	35.453 03	35.553 03	35.653 03	35.753 03
34.7	33.024 03	33.734 03	34.304 03	34.734 03	35.034 03	35.234 03	35.334 03	35.434 03	35.534 03	35.634 03	35.734 03	35.834 03
34.8	33.105 03	33.815 03	34.385 03	34.815 03	35.115 03	35.315 03	35.415 03	35.515 03	35.615 03	35.715 03	35.815 03	35.915 03
34.9	33.186 03	33.896 03	34.466 03	34.896 03	35.196 03	35.396 03	35.496 03	35.596 03	35.696 03	35.796 03	35.896 03	35.996 03
35.0	33.267 03	33.977 03	34.547 03	34.977 03	35.277 03	35.477 03	35.577 03	35.677 03	35.777 03	35.877 03	35.977 03	36.077 03

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

ν	0.75	0.80	0.85	0.90	0.95	1.00	1.50	2.00	2.50	3.00	4.00	5.00	6.00	7.00	8.00	10.00	15.00	20.00	25.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00		
1	1.32	1.38	1.43	1.48	1.53	1.58	1.64	1.69	1.74	1.79	1.84	1.89	1.94	1.99	2.04	2.09	2.14	2.19	2.24	2.29	2.34	2.39	2.44	2.49	2.54	2.59	2.64	2.69	
2	1.92	1.98	2.03	2.08	2.13	2.18	2.23	2.28	2.33	2.38	2.43	2.48	2.53	2.58	2.63	2.68	2.73	2.78	2.83	2.88	2.93	2.98	3.03	3.08	3.13	3.18	3.23	3.28	3.33
3	2.37	2.43	2.48	2.53	2.58	2.63	2.68	2.73	2.78	2.83	2.88	2.93	2.98	3.03	3.08	3.13	3.18	3.23	3.28	3.33	3.38	3.43	3.48	3.53	3.58	3.63	3.68	3.73	3.78
4	2.71	2.76	2.81	2.86	2.91	2.96	3.01	3.06	3.11	3.16	3.21	3.26	3.31	3.36	3.41	3.46	3.51	3.56	3.61	3.66	3.71	3.76	3.81	3.86	3.91	3.96	4.01	4.06	4.11
5	2.99	3.04	3.09	3.14	3.19	3.24	3.29	3.34	3.39	3.44	3.49	3.54	3.59	3.64	3.69	3.74	3.79	3.84	3.89	3.94	3.99	4.04	4.09	4.14	4.19	4.24	4.29	4.34	4.39
6	3.20	3.25	3.30	3.35	3.40	3.45	3.50	3.55	3.60	3.65	3.70	3.75	3.80	3.85	3.90	3.95	4.00	4.05	4.10	4.15	4.20	4.25	4.30	4.35	4.40	4.45	4.50	4.55	4.60
7	3.38	3.43	3.48	3.53	3.58	3.63	3.68	3.73	3.78	3.83	3.88	3.93	3.98	4.03	4.08	4.13	4.18	4.23	4.28	4.33	4.38	4.43	4.48	4.53	4.58	4.63	4.68	4.73	4.78
8	3.54	3.59	3.64	3.69	3.74	3.79	3.84	3.89	3.94	3.99	4.04	4.09	4.14	4.19	4.24	4.29	4.34	4.39	4.44	4.49	4.54	4.59	4.64	4.69	4.74	4.79	4.84	4.89	4.94
9	3.69	3.74	3.79	3.84	3.89	3.94	3.99	4.04	4.09	4.14	4.19	4.24	4.29	4.34	4.39	4.44	4.49	4.54	4.59	4.64	4.69	4.74	4.79	4.84	4.89	4.94	4.99	5.04	5.09
10	3.83	3.88	3.93	3.98	4.03	4.08	4.13	4.18	4.23	4.28	4.33	4.38	4.43	4.48	4.53	4.58	4.63	4.68	4.73	4.78	4.83	4.88	4.93	4.98	5.03	5.08	5.13	5.18	5.23
15	4.40	4.45	4.50	4.55	4.60	4.65	4.70	4.75	4.80	4.85	4.90	4.95	5.00	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45	5.50	5.55	5.60	5.65	5.70	5.75	5.80
20	4.85	4.90	4.95	5.00	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45	5.50	5.55	5.60	5.65	5.70	5.75	5.80	5.85	5.90	5.95	6.00	6.05	6.10	6.15	6.20	6.25
30	5.43	5.48	5.53	5.58	5.63	5.68	5.73	5.78	5.83	5.88	5.93	5.98	6.03	6.08	6.13	6.18	6.23	6.28	6.33	6.38	6.43	6.48	6.53	6.58	6.63	6.68	6.73	6.78	6.83
40	5.99	6.04	6.09	6.14	6.19	6.24	6.29	6.34	6.39	6.44	6.49	6.54	6.59	6.64	6.69	6.74	6.79	6.84	6.89	6.94	6.99	7.04	7.09	7.14	7.19	7.24	7.29	7.34	7.39
50	6.50	6.55	6.60	6.65	6.70	6.75	6.80	6.85	6.90	6.95	7.00	7.05	7.10	7.15	7.20	7.25	7.30	7.35	7.40	7.45	7.50	7.55	7.60	7.65	7.70	7.75	7.80	7.85	7.90
60	6.97	7.02	7.07	7.12	7.17	7.22	7.27	7.32	7.37	7.42	7.47	7.52	7.57	7.62	7.67	7.72	7.77	7.82	7.87	7.92	7.97	8.02	8.07	8.12	8.17	8.22	8.27	8.32	8.37
70	7.41	7.46	7.51	7.56	7.61	7.66	7.71	7.76	7.81	7.86	7.91	7.96	8.01	8.06	8.11	8.16	8.21	8.26	8.31	8.36	8.41	8.46	8.51	8.56	8.61	8.66	8.71	8.76	8.81
80	7.83	7.88	7.93	7.98	8.03	8.08	8.13	8.18	8.23	8.28	8.33	8.38	8.43	8.48	8.53	8.58	8.63	8.68	8.73	8.78	8.83	8.88	8.93	8.98	9.03	9.08	9.13	9.18	9.23
90	8.23	8.28	8.33	8.38	8.43	8.48	8.53	8.58	8.63	8.68	8.73	8.78	8.83	8.88	8.93	8.98	9.03	9.08	9.13	9.18	9.23	9.28	9.33	9.38	9.43	9.48	9.53	9.58	9.63
100	8.63	8.68	8.73	8.78	8.83	8.88	8.93	8.98	9.03	9.08	9.13	9.18	9.23	9.28	9.33	9.38	9.43	9.48	9.53	9.58	9.63	9.68	9.73	9.78	9.83	9.88	9.93	9.98	10.03

Percentage Points of Age \bar{A} Distribution
Values of \bar{A} in Terms of Q and F

	0.15000	0.20000	0.25000	0.30000	0.35000	0.40000	0.45000	0.50000	0.55000	0.60000	0.65000	0.70000	0.75000	0.80000	0.85000	0.90000	0.95000	1.00000
0.1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.9	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
1.0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

62.5	.65700	.95500	.34000	.03500	.33000	.02500	.02000	.01500	.01250	.01000
63.0	.65860	.95660	.34160	.03560	.33160	.02560	.02060	.01560	.01256	.01006
63.5	.66020	.95820	.34320	.03620	.33320	.02620	.02120	.01620	.01262	.01012
64.0	.66180	.95980	.34480	.03680	.33480	.02680	.02180	.01680	.01268	.01018
64.5	.66340	.96140	.34640	.03740	.33640	.02740	.02240	.01740	.01274	.01024
65.0	.66500	.96300	.34800	.03800	.33800	.02800	.02300	.01800	.01280	.01030
65.5	.66660	.96460	.34960	.03860	.33960	.02860	.02360	.01860	.01286	.01036
66.0	.66820	.96620	.35120	.03920	.34120	.02920	.02420	.01920	.01292	.01042
66.5	.66980	.96780	.35280	.03980	.34280	.02980	.02480	.01980	.01298	.01048
67.0	.67140	.96940	.35440	.04040	.34440	.03040	.02540	.02040	.01304	.01054
67.5	.67300	.97100	.35600	.04100	.34600	.03100	.02600	.02100	.01310	.01060
68.0	.67460	.97260	.35760	.04160	.34760	.03160	.02660	.02160	.01316	.01066
68.5	.67620	.97420	.35920	.04220	.34920	.03220	.02720	.02220	.01322	.01072
69.0	.67780	.97580	.36080	.04280	.35080	.03280	.02780	.02280	.01328	.01078
69.5	.67940	.97740	.36240	.04340	.35240	.03340	.02840	.02340	.01334	.01084
70.0	.68100	.97900	.36400	.04400	.35400	.03400	.02900	.02400	.01340	.01090
70.5	.68260	.98060	.36560	.04460	.35560	.03460	.02960	.02460	.01346	.01096
71.0	.68420	.98220	.36720	.04520	.35720	.03520	.03020	.02520	.01352	.01102
71.5	.68580	.98380	.36880	.04580	.35880	.03580	.03080	.02580	.01358	.01108
72.0	.68740	.98540	.37040	.04640	.36040	.03640	.03140	.02640	.01364	.01114
72.5	.68900	.98700	.37200	.04700	.36200	.03700	.03200	.02700	.01370	.01120
73.0	.69060	.98860	.37360	.04760	.36360	.03760	.03260	.02760	.01376	.01126
73.5	.69220	.99020	.37520	.04820	.36520	.03820	.03320	.02820	.01382	.01132
74.0	.69380	.99180	.37680	.04880	.36680	.03880	.03380	.02880	.01388	.01138
74.5	.69540	.99340	.37840	.04940	.36840	.03940	.03440	.02940	.01394	.01144
75.0	.69700	.99500	.38000	.05000	.37000	.04000	.03500	.03000	.01400	.01150
75.5	.69860	.99660	.38160	.05060	.37160	.04060	.03560	.03060	.01406	.01156
76.0	.69920	.99720	.38220	.05020	.37220	.04020	.03520	.03020	.01402	.01152
76.5	.70080	.99880	.38380	.05080	.37380	.04080	.03580	.03080	.01408	.01158
77.0	.70240	.10040	.38540	.05140	.37540	.04140	.03640	.03140	.01414	.01164
77.5	.70400	.10100	.38700	.05200	.37700	.04200	.03700	.03200	.01420	.01170
78.0	.70560	.10160	.38860	.05260	.37860	.04260	.03760	.03260	.01426	.01176
78.5	.70720	.10220	.39020	.05320	.38020	.04320	.03820	.03320	.01432	.01182
79.0	.70880	.10280	.39180	.05380	.38180	.04380	.03880	.03380	.01438	.01188
79.5	.71040	.10340	.39340	.05440	.38340	.04440	.03940	.03440	.01444	.01194
80.0	.71200	.10400	.39500	.05500	.38500	.04500	.04000	.03500	.01450	.01200
80.5	.71360	.10460	.39660	.05560	.38660	.04560	.04060	.03560	.01456	.01206
81.0	.71520	.10520	.39820	.05620	.38820	.04620	.04120	.03620	.01462	.01212
81.5	.71680	.10580	.39980	.05680	.38980	.04680	.04180	.03680	.01468	.01218
82.0	.71840	.10640	.40140	.05740	.39140	.04740	.04240	.03740	.01474	.01224
82.5	.72000	.10700	.40300	.05800	.39300	.04800	.04300	.03800	.01480	.01230
83.0	.72160	.10760	.40460	.05860	.39460	.04860	.04360	.03860	.01486	.01236
83.5	.72320	.10820	.40620	.05920	.39620	.04920	.04420	.03920	.01492	.01242
84.0	.72480	.10880	.40780	.05980	.39780	.04980	.04480	.03980	.01498	.01248
84.5	.72640	.10940	.40940	.06040	.39940	.05040	.04540	.04040	.01504	.01254
85.0	.72800	.11000	.41100	.06100	.40100	.05100	.04600	.04100	.01510	.01260
85.5	.72960	.11060	.41260	.06160	.40260	.05160	.04660	.04160	.01516	.01266
86.0	.73120	.11120	.41420	.06220	.40420	.05220	.04720	.04220	.01522	.01272
86.5	.73280	.11180	.41580	.06280	.40580	.05280	.04780	.04280	.01528	.01278
87.0	.73440	.11240	.41740	.06340	.40740	.05340	.04840	.04340	.01534	.01284

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and v

	.05000	.10000	.20000	.30000	.40000	.50000	.60000	.70000	.80000	.90000	.01000
187.0	.23304	.22736	.22557	.22712	.22763	.22812	.22863	.22913	.22963	.23013	.23559
188.0	.23284	.22716	.22537	.22692	.22743	.22793	.22843	.22893	.22943	.22993	.23540
189.0	.23264	.22696	.22517	.22672	.22723	.22773	.22823	.22873	.22923	.22973	.23520
190.0	.23244	.22676	.22497	.22652	.22703	.22753	.22803	.22853	.22903	.22953	.23500
191.0	.23224	.22656	.22477	.22632	.22683	.22733	.22783	.22833	.22883	.22933	.23480
192.0	.23204	.22636	.22457	.22612	.22663	.22713	.22763	.22813	.22863	.22913	.23460
193.0	.23184	.22616	.22437	.22592	.22643	.22693	.22743	.22793	.22843	.22893	.23440
194.0	.23164	.22596	.22417	.22572	.22623	.22673	.22723	.22773	.22823	.22873	.23420
195.0	.23144	.22576	.22397	.22552	.22603	.22653	.22703	.22753	.22803	.22853	.23400
196.0	.23124	.22556	.22377	.22532	.22583	.22633	.22683	.22733	.22783	.22833	.23380
197.0	.23104	.22536	.22357	.22512	.22563	.22613	.22663	.22713	.22763	.22813	.23360
198.0	.23084	.22516	.22337	.22492	.22543	.22593	.22643	.22693	.22743	.22793	.23340
199.0	.23064	.22496	.22317	.22472	.22523	.22573	.22623	.22673	.22723	.22773	.23320
200.0	.23044	.22476	.22297	.22452	.22503	.22553	.22603	.22653	.22703	.22753	.23300
201.0	.23024	.22456	.22277	.22432	.22483	.22533	.22583	.22633	.22683	.22733	.23280
202.0	.23004	.22436	.22257	.22412	.22463	.22513	.22563	.22613	.22663	.22713	.23260
203.0	.22984	.22416	.22237	.22392	.22443	.22493	.22543	.22593	.22643	.22693	.23240
204.0	.22964	.22396	.22217	.22372	.22423	.22473	.22523	.22573	.22623	.22673	.23220
205.0	.22944	.22376	.22197	.22352	.22403	.22453	.22503	.22553	.22603	.22653	.23200
206.0	.22924	.22356	.22177	.22332	.22383	.22433	.22483	.22533	.22583	.22633	.23180
207.0	.22904	.22336	.22157	.22312	.22363	.22413	.22463	.22513	.22563	.22613	.23160
208.0	.22884	.22316	.22137	.22292	.22343	.22393	.22443	.22493	.22543	.22593	.23140
209.0	.22864	.22296	.22117	.22272	.22323	.22373	.22423	.22473	.22523	.22573	.23120
210.0	.22844	.22276	.22097	.22252	.22303	.22353	.22403	.22453	.22503	.22553	.23100
211.0	.22824	.22256	.22077	.22232	.22283	.22333	.22383	.22433	.22483	.22533	.23080
212.0	.22804	.22236	.22057	.22212	.22263	.22313	.22363	.22413	.22463	.22513	.23060
213.0	.22784	.22216	.22037	.22192	.22243	.22293	.22343	.22393	.22443	.22493	.23040
214.0	.22764	.22196	.22017	.22172	.22223	.22273	.22323	.22373	.22423	.22473	.23020
215.0	.22744	.22176	.21997	.22152	.22203	.22253	.22303	.22353	.22403	.22453	.23000
216.0	.22724	.22156	.21977	.22132	.22183	.22233	.22283	.22333	.22383	.22433	.22980
217.0	.22704	.22136	.21957	.22102	.22153	.22203	.22253	.22303	.22353	.22403	.22960
218.0	.22684	.22116	.21937	.22092	.22143	.22193	.22243	.22293	.22343	.22393	.22940
219.0	.22664	.22096	.21917	.22072	.22123	.22173	.22223	.22273	.22323	.22373	.22920
220.0	.22644	.22076	.21897	.22052	.22103	.22153	.22203	.22253	.22303	.22353	.22900
221.0	.22624	.22056	.21877	.22032	.22083	.22133	.22183	.22233	.22283	.22333	.22880
222.0	.22604	.22036	.21857	.22012	.22063	.22113	.22163	.22213	.22263	.22313	.22860
223.0	.22584	.22016	.21837	.21992	.22043	.22093	.22143	.22193	.22243	.22293	.22840
224.0	.22564	.21996	.21817	.21972	.22023	.22073	.22123	.22173	.22223	.22273	.22820
225.0	.22544	.21976	.21797	.21952	.22003	.22053	.22103	.22153	.22203	.22253	.22800
226.0	.22524	.21956	.21777	.21932	.21983	.22033	.22083	.22133	.22183	.22233	.22780
227.0	.22504	.21936	.21757	.21912	.21963	.22013	.22063	.22113	.22163	.22213	.22760
228.0	.22484	.21916	.21737	.21892	.21943	.21993	.22043	.22093	.22143	.22193	.22740
229.0	.22464	.21896	.21717	.21872	.21923	.21973	.22023	.22073	.22123	.22173	.22720
230.0	.22444	.21876	.21697	.21852	.21903	.21953	.22003	.22053	.22103	.22153	.22700
231.0	.22424	.21856	.21677	.21832	.21883	.21933	.21983	.22033	.22083	.22133	.22680
232.0	.22404	.21836	.21657	.21812	.21863	.21913	.21963	.22013	.22063	.22113	.22660
233.0	.22384	.21816	.21637	.21792	.21843	.21893	.21943	.21993	.22043	.22093	.22640
234.0	.22364	.21796	.21617	.21772	.21823	.21873	.21923	.21973	.22023	.22073	.22620
235.0	.22344	.21776	.21597	.21752	.21803	.21853	.21903	.21953	.22003	.22053	.22600
236.0	.22324	.21756	.21577	.21732	.21783	.21833	.21883	.21933	.21983	.22033	.22580
237.0	.22304	.21736	.21557	.21712	.21763	.21813	.21863	.21913	.21963	.22013	.22560
238.0	.22284	.21716	.21537	.21692	.21743	.21793	.21843	.21893	.21943	.21993	.22540
239.0	.22264	.21696	.21517	.21672	.21723	.21773	.21823	.21873	.21923	.21973	.22520
240.0	.22244	.21676	.21497	.21652	.21703	.21753	.21803	.21853	.21903	.21953	.22500
241.0	.22224	.21656	.21477	.21632	.21683	.21733	.21783	.21833	.21883	.21933	.22480
242.0	.22204	.21636	.21457	.21612	.21663	.21713	.21763	.21813	.21863	.21913	.22460
243.0	.22184	.21616	.21437	.21592	.21643	.21693	.21743	.21793	.21843	.21893	.22440
244.0	.22164	.21596	.21417	.21572	.21623	.21673	.21723	.21773	.21823	.21873	.22420
245.0	.22144	.21576	.21397	.21552	.21603	.21653	.21703	.21753	.21803	.21853	.22400
246.0	.22124	.21556	.21377	.21532	.21583	.21633	.21683	.21733	.21783	.21833	.22380
247.0	.22104	.21536	.21357	.21512	.21563	.21613	.21663	.21713	.21763	.21813	.22360
248.0	.22084	.21516	.21337	.21492	.21543	.21593	.21643	.21693	.21743	.21793	.22340
249.0	.22064	.21496	.21317	.21472	.21523	.21573	.21623	.21673	.21723	.21773	.22320
250.0	.22044	.21476	.21297	.21452	.21503	.21553	.21603	.21653	.21703	.21753	.22300

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and r

Q	r	0.95000	0.90000	0.85000	0.80000	0.75000	0.70000	0.65000	0.60000
20.0	0.95	1.1780	1.2742	1.3745	1.4790	1.5878	1.7001	1.8161	1.9358
20.0	0.90	1.2228	1.3215	1.4239	1.5300	1.6408	1.7563	1.8754	1.9981
20.0	0.85	1.2683	1.3683	1.4728	1.5817	1.6950	1.8127	1.9338	2.0583
20.0	0.80	1.3147	1.4161	1.5222	1.6330	1.7484	1.8683	1.9916	2.1181
20.0	0.75	1.3620	1.4648	1.5712	1.6820	1.7973	1.9170	2.0401	2.1844
20.0	0.70	1.4101	1.5143	1.6212	1.7319	1.8471	1.9666	2.0891	2.2430
20.0	0.65	1.4590	1.5645	1.6720	1.7826	1.8976	2.0161	2.1401	2.3000
20.0	0.60	1.5087	1.6156	1.7245	1.8351	1.9499	2.0674	2.1911	2.3543
20.0	0.55	1.5592	1.6675	1.7770	1.8874	1.9999	2.1145	2.2371	2.4060
20.0	0.50	1.6104	1.7201	1.8300	1.9401	2.0514	2.1639	2.2791	2.4550
20.0	0.45	1.6623	1.7728	1.8820	1.9911	2.1001	2.2121	2.3271	2.5010
20.0	0.40	1.7149	1.8260	1.9345	2.0426	2.1491	2.2561	2.3631	2.5440
20.0	0.35	1.7681	1.8795	1.9870	2.0941	2.1991	2.3011	2.4011	2.5840
20.0	0.30	1.8219	1.9340	2.0400	2.1451	2.2491	2.3461	2.4411	2.6210
20.0	0.25	1.8763	1.9880	2.0920	2.1901	2.2931	2.3811	2.4711	2.6550
20.0	0.20	1.9313	2.0430	2.1460	2.2351	2.3371	2.4261	2.5111	2.6860
20.0	0.15	1.9869	2.0980	2.1990	2.2801	2.3811	2.4701	2.5511	2.7140
20.0	0.10	2.0431	2.1540	2.2540	2.3461	2.4461	2.5351	2.6111	2.7390
20.0	0.05	2.1000	2.2110	2.3100	2.4011	2.4911	2.5711	2.6411	2.7610
20.0	0.00	2.1575	2.2680	2.3660	2.4571	2.5471	2.6271	2.6971	2.7710
20.0	0.05	2.2156	2.3260	2.4240	2.5151	2.6051	2.6851	2.7551	2.8210
20.0	0.10	2.2743	2.3850	2.4820	2.5731	2.6631	2.7431	2.8131	2.8790
20.0	0.15	2.3335	2.4440	2.5400	2.6311	2.7211	2.8011	2.8711	2.9370
20.0	0.20	2.3933	2.5030	2.5980	2.6891	2.7791	2.8591	2.9291	2.9970
20.0	0.25	2.4536	2.5640	2.6590	2.7501	2.8401	2.9201	2.9901	3.0570
20.0	0.30	2.5144	2.6250	2.7200	2.8111	2.9011	2.9811	3.0511	3.1170
20.0	0.35	2.5757	2.6860	2.7810	2.8721	2.9621	3.0421	3.1121	3.1770
20.0	0.40	2.6375	2.7480	2.8430	2.9341	3.0241	3.1041	3.1741	3.2370
20.0	0.45	2.6998	2.8100	2.9050	2.9961	3.0861	3.1661	3.2361	3.2970
20.0	0.50	2.7626	2.8720	2.9670	3.0581	3.1481	3.2281	3.2981	3.3580
20.0	0.55	2.8259	2.9360	3.0310	3.1211	3.2111	3.2911	3.3611	3.4220
20.0	0.60	2.8897	2.9990	3.0940	3.1821	3.2721	3.3521	3.4221	3.4820
20.0	0.65	2.9540	3.0640	3.1590	3.2501	3.3411	3.4211	3.4911	3.5510
20.0	0.70	3.0188	3.1280	3.2230	3.3141	3.4051	3.4851	3.5551	3.6150
20.0	0.75	3.0841	3.1930	3.2880	3.3791	3.4701	3.5501	3.6201	3.6800
20.0	0.80	3.1499	3.2580	3.3530	3.4441	3.5351	3.6151	3.6851	3.7450
20.0	0.85	3.2162	3.3240	3.4190	3.5101	3.6011	3.6811	3.7511	3.8110
20.0	0.90	3.2830	3.3910	3.4860	3.5771	3.6681	3.7481	3.8181	3.8780
20.0	0.95	3.3503	3.4580	3.5530	3.6441	3.7351	3.8151	3.8851	3.9450
20.0	1.00	3.4181	3.5260	3.6210	3.7121	3.8031	3.8831	3.9531	4.0130

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of α and r

α	$r=1$	$r=2$	$r=3$	$r=4$	$r=5$	$r=6$	$r=7$	$r=8$	$r=9$	$r=10$	$r=11$	$r=12$	$r=13$	$r=14$	$r=15$	$r=16$	$r=17$	$r=18$	$r=19$	$r=20$	
0.10	1.6755	2.3371	2.8331	3.2192	3.5515	3.8397	4.0891	4.3054	4.4942	4.6611	4.8117	4.9507	5.0827	5.2097	5.3327	5.4517	5.5677	5.6807	5.7907	5.8977	6.0017
0.05	3.8415	5.0239	5.9914	6.7514	7.3778	7.8794	8.2909	8.6424	8.9443	9.2072	9.4418	9.6581	9.8561	10.0377	10.2039	10.3557	10.5031	10.6461	10.7847	10.9189	11.0487
0.01	6.6349	7.8794	8.5379	9.1416	9.6011	10.0272	10.4197	10.7784	11.1031	11.3947	11.6531	11.8794	12.0737	12.2459	12.3961	12.5343	12.6615	12.7787	12.8859	12.9831	13.0713
0.001	10.8281	12.5916	13.4424	14.1887	14.8314	15.3714	15.8187	16.2731	16.7347	17.1931	17.6481	18.0997	18.5471	18.9901	19.4287	19.8621	20.2901	20.7127	21.1301	21.5421	21.9487

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

ν	.05000	.04000	.03500	.03000	.02500	.02000	.01500	.012500	.01000
362.5	.497697 03	.493986 03	.492781 03	.491485 03	.491142 03	.490920 03	.423363 03	.425515 03	.428063 03
363.0	.498427 03	.494716 03	.493511 03	.492215 03	.491872 03	.491650 03	.423923 03	.426056 03	.428607 03
363.5	.498758 03	.495047 03	.493842 03	.492546 03	.492203 03	.491981 03	.424463 03	.426598 03	.429150 03
364.0	.499488 02	.495777 03	.494572 03	.493276 03	.492933 03	.492711 03	.425004 03	.427139 03	.429693 03
364.5	.499819 03	.496108 03	.494903 03	.493607 03	.493264 03	.493042 03	.425544 03	.427681 03	.430236 03
365.0	.499950 03	.496239 03	.495034 03	.493738 03	.493395 03	.493173 03	.426084 03	.428223 03	.430779 03
365.5	.499981 03	.496270 03	.495065 03	.493769 03	.493426 03	.493204 03	.426624 03	.428764 03	.431322 03
366.0	.499992 03	.496281 03	.495076 03	.493780 03	.493437 03	.493215 03	.427164 03	.429305 03	.431865 03
366.5	.499995 03	.496284 03	.495079 03	.493783 03	.493440 03	.493218 03	.427704 03	.429847 03	.432408 03
367.0	.499996 03	.496285 03	.495080 03	.493784 03	.493441 03	.493219 03	.428244 03	.430388 03	.432951 03
367.5	.499997 03	.496286 03	.495081 03	.493785 03	.493442 03	.493220 03	.428784 03	.430930 03	.433494 03
368.0	.499998 03	.496287 03	.495082 03	.493786 03	.493443 03	.493221 03	.429324 03	.431471 03	.434037 03
368.5	.499999 03	.496288 03	.495083 03	.493787 03	.493444 03	.493222 03	.429864 03	.432012 03	.434580 03
369.0	.499999 03	.496289 03	.495084 03	.493788 03	.493445 03	.493223 03	.430404 03	.432554 03	.435123 03
369.5	.499999 03	.496290 03	.495085 03	.493789 03	.493446 03	.493224 03	.430944 03	.433095 03	.435665 03
370.0	.499999 03	.496291 03	.495086 03	.493790 03	.493447 03	.493225 03	.431484 03	.433636 03	.436208 03
370.5	.499999 03	.496292 03	.495087 03	.493791 03	.493448 03	.493226 03	.432024 03	.434177 03	.436751 03
371.0	.499999 03	.496293 03	.495088 03	.493792 03	.493449 03	.493227 03	.432564 03	.434718 03	.437294 03
371.5	.499999 03	.496294 03	.495089 03	.493793 03	.493450 03	.493228 03	.433104 03	.435260 03	.437836 03
372.0	.499999 03	.496295 03	.495090 03	.493794 03	.493451 03	.493229 03	.433644 03	.435801 03	.438379 03
372.5	.499999 03	.496296 03	.495091 03	.493795 03	.493452 03	.493230 03	.434184 03	.436342 03	.438922 03
373.0	.499999 03	.496297 03	.495092 03	.493796 03	.493453 03	.493231 03	.434724 03	.436883 03	.439464 03
373.5	.499999 03	.496298 03	.495093 03	.493797 03	.493454 03	.493232 03	.435264 03	.437424 03	.440007 03
374.0	.499999 03	.496299 03	.495094 03	.493798 03	.493455 03	.493233 03	.435804 03	.437965 03	.440550 03
374.5	.499999 03	.496300 03	.495095 03	.493799 03	.493456 03	.493234 03	.436344 03	.438506 03	.441092 03
375.0	.499999 03	.496301 03	.495096 03	.493800 03	.493457 03	.493235 03	.436884 03	.439047 03	.441635 03
375.5	.499999 03	.496302 03	.495097 03	.493801 03	.493458 03	.493236 03	.437424 03	.439588 03	.442177 03
376.0	.499999 03	.496303 03	.495098 03	.493802 03	.493459 03	.493237 03	.437961 03	.440129 03	.442719 03
376.5	.499999 03	.496304 03	.495099 03	.493803 03	.493460 03	.493238 03	.438501 03	.440670 03	.443262 03
377.0	.499999 03	.496305 03	.495100 03	.493804 03	.493461 03	.493239 03	.439040 03	.441210 03	.443804 03
377.5	.499999 03	.496306 03	.495101 03	.493805 03	.493462 03	.493240 03	.439580 03	.441751 03	.444347 03
378.0	.499999 03	.496307 03	.495102 03	.493806 03	.493463 03	.493241 03	.440119 03	.442292 03	.444889 03
378.5	.499999 03	.496308 03	.495103 03	.493807 03	.493464 03	.493242 03	.440659 03	.442833 03	.445431 03
379.0	.499999 03	.496309 03	.495104 03	.493808 03	.493465 03	.493243 03	.441198 03	.443373 03	.445974 03
379.5	.499999 03	.496310 03	.495105 03	.493809 03	.493466 03	.493244 03	.441738 03	.443914 03	.446516 03
380.0	.499999 03	.496311 03	.495106 03	.493810 03	.493467 03	.493245 03	.442277 03	.444455 03	.447058 03
380.5	.499999 03	.496312 03	.495107 03	.493811 03	.493468 03	.493246 03	.442816 03	.444995 03	.447600 03
381.0	.499999 03	.496313 03	.495108 03	.493812 03	.493469 03	.493247 03	.443356 03	.445536 03	.448142 03
381.5	.499999 03	.496314 03	.495109 03	.493813 03	.493470 03	.493248 03	.443895 03	.446077 03	.448684 03
382.0	.499999 03	.496315 03	.495110 03	.493814 03	.493471 03	.493249 03	.444434 03	.446617 03	.449227 03
382.5	.499999 03	.496316 03	.495111 03	.493815 03	.493472 03	.493250 03	.444974 03	.447158 03	.449769 03
383.0	.499999 03	.496317 03	.495112 03	.493816 03	.493473 03	.493251 03	.445513 03	.447698 03	.450311 03
383.5	.499999 03	.496318 03	.495113 03	.493817 03	.493474 03	.493252 03	.446052 03	.448239 03	.450853 03
384.0	.499999 03	.496319 03	.495114 03	.493818 03	.493475 03	.493253 03	.446591 03	.448779 03	.451395 03
384.5	.499999 03	.496320 03	.495115 03	.493819 03	.493476 03	.493254 03	.447130 03	.449320 03	.451937 03
385.0	.499999 03	.496321 03	.495116 03	.493820 03	.493477 03	.493255 03	.447669 03	.449860 03	.452479 03
385.5	.499999 03	.496322 03	.495117 03	.493821 03	.493478 03	.493256 03	.448209 03	.450400 03	.453021 03
386.0	.499999 03	.496323 03	.495118 03	.493822 03	.493479 03	.493257 03	.448748 03	.450941 03	.453562 03
386.5	.499999 03	.496324 03	.495119 03	.493823 03	.493480 03	.493258 03	.449287 03	.451481 03	.454104 03
387.0	.499999 03	.496325 03	.495120 03	.493824 03	.493481 03	.493259 03	.449826 03	.452021 03	.454646 03

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$	.05000	.04000	.03500	.03000	.02500	.02000	.01500	.01250	.01000
387.5	.435919	.437566	.439436	.441524	.443932	.446796	.450365	.452562	.455188
388.0	.434929	.436117	.437969	.440258	.442667	.445332	.449094	.451202	.453730
388.5	.435458	.436649	.438501	.440790	.443199	.445869	.450043	.452542	.455271
389.0	.435988	.437180	.439034	.441325	.443734	.446406	.450982	.453482	.456313
389.5	.436517	.437711	.439566	.441859	.444268	.447043	.451921	.454423	.457355
390.0	.437047	.438243	.440099	.442393	.444803	.447578	.452663	.455263	.458297
390.5	.437576	.438774	.440631	.442926	.445336	.448117	.453398	.455983	.458920
391.0	.438106	.439305	.441164	.443460	.445870	.448653	.453934	.456513	.459450
391.5	.438635	.439837	.441696	.443993	.446403	.449186	.454467	.457040	.459977
392.0	.439165	.440368	.442228	.444525	.446935	.449718	.454999	.457567	.460503
392.5	.439694	.440899	.442759	.445056	.447466	.450249	.455530	.458093	.461029
393.0	.440223	.441430	.443291	.445588	.448000	.450783	.456064	.458622	.461558
393.5	.440753	.441962	.443823	.446120	.448532	.451315	.456596	.459154	.462090
394.0	.441282	.442493	.444354	.446651	.449063	.451846	.457127	.459685	.462621
394.5	.441811	.443024	.444885	.447182	.449594	.452377	.457658	.460216	.463152
395.0	.442341	.443554	.445415	.447712	.450124	.452907	.458188	.460746	.463682
395.5	.442870	.444084	.445945	.448242	.450654	.453437	.458718	.461306	.464238
396.0	.443399	.444614	.446475	.448772	.451184	.453967	.459248	.461866	.464807
396.5	.443928	.445144	.447005	.449302	.451714	.454497	.459778	.462426	.465293
397.0	.444458	.445674	.447535	.449832	.452244	.455027	.460308	.462868	.465795
397.5	.444987	.446204	.448065	.450362	.452774	.455557	.460838	.463398	.466325
398.0	.445516	.446733	.448594	.450891	.453303	.456086	.461358	.463918	.466845
398.5	.446045	.447262	.449123	.451420	.453832	.456615	.461878	.464438	.467365
399.0	.446574	.447791	.449652	.451949	.454361	.457144	.462398	.464958	.467885
399.5	.447103	.448320	.450181	.452478	.454890	.457673	.462918	.465478	.468405
400.0	.447632	.448849	.450710	.453007	.455419	.458202	.463438	.465998	.468925
400.5	.448162	.449379	.451240	.453537	.455949	.458732	.463958	.466518	.469445
401.0	.448691	.449908	.451769	.454066	.456478	.459261	.464478	.467038	.470005
401.5	.449220	.450437	.452308	.454605	.457017	.459800	.464998	.467558	.470525
402.0	.449749	.450966	.452837	.455134	.457546	.460329	.465509	.468069	.471085
402.5	.450278	.451495	.453366	.455673	.458085	.460868	.466048	.468608	.471625
403.0	.450807	.452024	.453895	.456202	.458614	.461397	.466577	.469137	.472162
403.5	.451336	.452553	.454424	.456731	.459143	.461926	.467106	.469666	.472700
404.0	.451865	.453082	.454953	.457260	.459672	.462449	.467629	.470189	.473226
404.5	.452394	.453611	.455482	.457789	.460201	.462984	.468164	.470724	.473761
405.0	.452923	.454140	.456011	.458318	.460730	.463513	.468693	.471244	.474281
405.5	.453452	.454669	.456540	.458847	.461259	.464042	.469222	.471704	.474741
406.0	.453981	.455198	.457069	.459376	.461788	.464571	.469751	.472206	.475243
406.5	.454510	.455727	.457598	.459905	.462317	.465099	.470279	.472741	.475778
407.0	.455039	.456256	.458127	.460434	.462846	.465629	.470800	.473262	.476299
407.5	.455568	.456785	.458656	.460963	.463375	.466158	.471320	.473782	.476819
408.0	.456097	.457314	.459185	.461492	.463904	.466687	.471840	.474302	.477339
408.5	.456626	.457843	.459714	.462001	.464413	.467196	.472360	.474822	.477859
409.0	.457155	.458372	.460243	.462550	.464962	.467745	.472880	.475342	.478379
409.5	.457684	.458901	.460772	.463079	.465491	.468274	.473400	.475862	.478899
410.0	.458213	.459430	.461301	.463608	.466020	.468803	.473920	.476382	.479419
410.5	.458742	.459959	.461830	.464137	.466549	.469332	.474440	.476902	.480000
411.0	.459271	.460488	.462369	.464676	.467088	.469871	.474960	.477422	.480519
411.5	.459800	.461017	.462898	.465205	.467617	.470400	.475480	.477942	.481038
412.0	.460329	.461546	.463427	.465734	.468146	.470929	.475999	.478462	.481491

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and ν

ν	.05000	.10000	.20000	.30000	.40000	.50000	.60000	.70000	.80000	.90000	1.00000
60.0	51.977	52.977	53.977	54.977	55.977	56.977	57.977	58.977	59.977	60.977	61.977
60.1	52.077	53.077	54.077	55.077	56.077	57.077	58.077	59.077	60.077	61.077	62.077
60.2	52.177	53.177	54.177	55.177	56.177	57.177	58.177	59.177	60.177	61.177	62.177
60.3	52.277	53.277	54.277	55.277	56.277	57.277	58.277	59.277	60.277	61.277	62.277
60.4	52.377	53.377	54.377	55.377	56.377	57.377	58.377	59.377	60.377	61.377	62.377
60.5	52.477	53.477	54.477	55.477	56.477	57.477	58.477	59.477	60.477	61.477	62.477
60.6	52.577	53.577	54.577	55.577	56.577	57.577	58.577	59.577	60.577	61.577	62.577
60.7	52.677	53.677	54.677	55.677	56.677	57.677	58.677	59.677	60.677	61.677	62.677
60.8	52.777	53.777	54.777	55.777	56.777	57.777	58.777	59.777	60.777	61.777	62.777
60.9	52.877	53.877	54.877	55.877	56.877	57.877	58.877	59.877	60.877	61.877	62.877
61.0	52.977	53.977	54.977	55.977	56.977	57.977	58.977	59.977	60.977	61.977	62.977
61.1	53.077	54.077	55.077	56.077	57.077	58.077	59.077	60.077	61.077	62.077	63.077
61.2	53.177	54.177	55.177	56.177	57.177	58.177	59.177	60.177	61.177	62.177	63.177
61.3	53.277	54.277	55.277	56.277	57.277	58.277	59.277	60.277	61.277	62.277	63.277
61.4	53.377	54.377	55.377	56.377	57.377	58.377	59.377	60.377	61.377	62.377	63.377
61.5	53.477	54.477	55.477	56.477	57.477	58.477	59.477	60.477	61.477	62.477	63.477
61.6	53.577	54.577	55.577	56.577	57.577	58.577	59.577	60.577	61.577	62.577	63.577
61.7	53.677	54.677	55.677	56.677	57.677	58.677	59.677	60.677	61.677	62.677	63.677
61.8	53.777	54.777	55.777	56.777	57.777	58.777	59.777	60.777	61.777	62.777	63.777
61.9	53.877	54.877	55.877	56.877	57.877	58.877	59.877	60.877	61.877	62.877	63.877
62.0	53.977	54.977	55.977	56.977	57.977	58.977	59.977	60.977	61.977	62.977	63.977

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$.807500	.835100	.862500	.890000	.917500	.945000	.972500	1.000000	1.027500	1.055000	1.082500	1.110000	1.137500	1.165000	1.192500	1.220000	1.247500	1.275000	1.302500	1.330000	1.357500	1.385000	1.412500	1.440000	1.467500	1.495000	1.522500	1.550000	1.577500	1.605000	1.632500	1.660000	1.687500	1.715000	1.742500	1.770000	1.797500	1.825000	1.852500	1.880000	1.907500	1.935000	1.962500	1.990000	2.017500	2.045000	2.072500	2.100000	2.127500	2.155000	2.182500	2.210000	2.237500	2.265000	2.292500	2.320000	2.347500	2.375000	2.402500	2.430000	2.457500	2.485000	2.512500	2.540000	2.567500	2.595000	2.622500	2.650000	2.677500	2.705000	2.732500	2.760000	2.787500	2.815000	2.842500	2.870000	2.897500	2.925000	2.952500	2.980000	3.007500	3.035000	3.062500	3.090000	3.117500	3.145000	3.172500	3.200000	3.227500	3.255000	3.282500	3.310000	3.337500	3.365000	3.392500	3.420000	3.447500	3.475000	3.502500	3.530000	3.557500	3.585000	3.612500	3.640000	3.667500	3.695000	3.722500	3.750000	3.777500	3.805000	3.832500	3.860000	3.887500	3.915000	3.942500	3.970000	3.997500	4.025000	4.052500	4.080000	4.107500	4.135000	4.162500	4.190000	4.217500	4.245000	4.272500	4.300000	4.327500	4.355000	4.382500	4.410000	4.437500	4.465000	4.492500	4.520000	4.547500	4.575000	4.602500	4.630000	4.657500	4.685000	4.712500	4.740000	4.767500	4.795000	4.822500	4.850000	4.877500	4.905000	4.932500	4.960000	4.987500	5.015000	5.042500	5.070000	5.097500	5.125000	5.152500	5.180000	5.207500	5.235000	5.262500	5.290000	5.317500	5.345000	5.372500	5.400000	5.427500	5.455000	5.482500	5.510000	5.537500	5.565000	5.592500	5.620000	5.647500	5.675000	5.702500	5.730000	5.757500	5.785000	5.812500	5.840000	5.867500	5.895000	5.922500	5.950000	5.977500	6.005000	6.032500	6.060000	6.087500	6.115000	6.142500	6.170000	6.197500	6.225000	6.252500	6.280000	6.307500	6.335000	6.362500	6.390000	6.417500	6.445000	6.472500	6.500000	6.527500	6.555000	6.582500	6.610000	6.637500	6.665000	6.692500	6.720000	6.747500	6.775000	6.802500	6.830000	6.857500	6.885000	6.912500	6.940000	6.967500	6.995000	7.022500	7.050000	7.077500	7.105000	7.132500	7.160000	7.187500	7.215000	7.242500	7.270000	7.297500	7.325000	7.352500	7.380000	7.407500	7.435000	7.462500	7.490000	7.517500	7.545000	7.572500	7.600000	7.627500	7.655000	7.682500	7.710000	7.737500	7.765000	7.792500	7.820000	7.847500	7.875000	7.902500	7.930000	7.957500	7.985000	8.012500	8.040000	8.067500	8.095000	8.122500	8.150000	8.177500	8.205000	8.232500	8.260000	8.287500	8.315000	8.342500	8.370000	8.397500	8.425000	8.452500	8.480000	8.507500	8.535000	8.562500	8.590000	8.617500	8.645000	8.672500	8.700000	8.727500	8.755000	8.782500	8.810000	8.837500	8.865000	8.892500	8.920000	8.947500	8.975000	9.002500	9.030000	9.057500	9.085000	9.112500	9.140000	9.167500	9.195000	9.222500	9.250000	9.277500	9.305000	9.332500	9.360000	9.387500	9.415000	9.442500	9.470000	9.497500	9.525000	9.552500	9.580000	9.607500	9.635000	9.662500	9.690000	9.717500	9.745000	9.772500	9.800000	9.827500	9.855000	9.882500	9.910000	9.937500	9.965000	9.992500	10.020000	10.047500	10.075000	10.102500	10.130000	10.157500	10.185000	10.212500	10.240000	10.267500	10.295000	10.322500	10.350000	10.377500	10.405000	10.432500	10.460000	10.487500	10.515000	10.542500	10.570000	10.597500	10.625000	10.652500	10.680000	10.707500	10.735000	10.762500	10.790000	10.817500	10.845000	10.872500	10.900000	10.927500	10.955000	10.982500	11.010000	11.037500	11.065000	11.092500	11.120000	11.147500	11.175000	11.202500	11.230000	11.257500	11.285000	11.312500	11.340000	11.367500	11.395000	11.422500	11.450000	11.477500	11.505000	11.532500	11.560000	11.587500	11.615000	11.642500	11.670000	11.697500	11.725000	11.752500	11.780000	11.807500	11.835000	11.862500	11.890000	11.917500	11.945000	11.972500	12.000000	12.027500	12.055000	12.082500	12.110000	12.137500	12.165000	12.192500	12.220000	12.247500	12.275000	12.302500	12.330000	12.357500	12.385000	12.412500	12.440000	12.467500	12.495000	12.522500	12.550000	12.577500	12.605000	12.632500	12.660000	12.687500	12.715000	12.742500	12.770000	12.797500	12.825000	12.852500	12.880000	12.907500	12.935000	12.962500	12.990000	13.017500	13.045000	13.072500	13.100000	13.127500	13.155000	13.182500	13.210000	13.237500	13.265000	13.292500	13.320000	13.347500	13.375000	13.402500	13.430000	13.457500	13.485000	13.512500	13.540000	13.567500	13.595000	13.622500	13.650000	13.677500	13.705000	13.732500	13.760000	13.787500	13.815000	13.842500	13.870000	13.897500	13.925000	13.952500	13.980000	14.007500	14.035000	14.062500	14.090000	14.117500	14.145000	14.172500	14.200000	14.227500	14.255000	14.282500	14.310000	14.337500	14.365000	14.392500	14.420000	14.447500	14.475000	14.502500	14.530000	14.557500	14.585000	14.612500	14.640000	14.667500	14.695000	14.722500	14.750000	14.777500	14.805000	14.832500	14.860000	14.887500	14.915000	14.942500	14.970000	15.000000
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Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

$\nu \backslash Q$.007500	.005000	.002500	.001000	.000500	.000100	.000050	.000010	.000005	.000001
5.1	.159595	.169330	.185759	.207135	.223095	.259608	.275143	.310866	.326123	.361309
5.2	.163377	.171156	.187652	.209109	.225126	.261756	.277336	.313156	.328453	.363722
5.3	.166919	.174793	.191362	.212842	.228936	.265619	.281295	.317192	.332570	.367922
5.4	.170325	.178299	.194947	.216436	.232642	.269372	.285147	.321157	.336625	.372062
5.5	.173607	.181682	.198410	.219933	.236245	.272947	.288812	.324634	.340292	.375812
5.6	.176767	.184943	.201751	.223412	.240000	.276409	.292374	.328082	.343940	.379552
5.7	.179815	.188092	.205000	.226842	.243446	.279842	.295822	.331519	.347579	.383282
5.8	.182762	.191140	.208209	.230246	.246895	.283246	.299272	.334956	.351218	.387012
5.9	.185628	.194107	.211200	.233624	.250357	.286624	.302722	.338395	.354857	.390742
6.0	.188423	.197000	.214142	.236978	.253424	.289978	.306172	.341834	.358498	.394472
6.1	.191157	.199850	.217036	.240310	.256457	.293310	.309622	.344813	.362139	.398202
6.2	.193831	.202434	.219880	.243624	.259457	.296624	.313072	.347792	.365780	.401932
6.3	.196455	.205000	.222709	.246919	.262424	.299919	.316522	.350772	.369421	.405662
6.4	.199029	.207525	.225500	.250195	.265357	.303209	.319972	.353762	.373062	.409392
6.5	.201553	.210036	.228250	.253446	.268257	.306495	.323422	.356752	.376703	.413122
6.6	.204027	.212460	.231000	.256672	.271172	.309772	.326872	.359742	.380344	.416852
6.7	.206451	.214834	.233624	.259872	.273812	.313046	.330322	.362732	.383985	.420582
6.8	.208825	.217157	.236172	.263046	.276424	.316310	.333872	.365722	.387626	.424312
6.9	.211149	.219423	.238424	.266246	.279012	.319572	.337422	.368712	.391267	.428042
7.0	.213423	.221697	.240692	.269457	.281582	.322812	.340972	.371703	.394908	.431772
7.1	.215697	.223971	.242916	.272672	.284172	.326046	.344522	.374692	.398549	.435502
7.2	.217971	.226245	.245090	.275812	.286742	.329272	.348072	.377682	.402190	.439232
7.3	.220245	.228519	.247264	.278957	.289312	.332500	.351622	.380672	.405831	.442962
7.4	.222519	.230793	.249438	.282112	.291882	.335736	.355172	.383662	.409472	.446692
7.5	.224793	.233067	.251612	.285272	.294452	.338972	.358722	.386652	.413113	.450422
7.6	.227067	.235341	.253786	.288424	.297022	.342209	.362272	.389642	.416754	.454152
7.7	.229341	.237615	.255960	.291572	.299592	.345446	.365822	.392632	.420395	.457882
7.8	.231615	.239889	.258134	.294712	.302162	.348692	.369412	.395622	.424036	.461612
7.9	.233889	.242163	.260308	.297857	.304732	.351936	.372972	.398612	.427677	.465342
8.0	.236163	.244437	.262482	.300992	.307302	.355172	.376522	.401662	.431318	.469072
8.1	.238437	.246711	.264656	.304142	.310000	.358418	.380072	.404712	.434959	.472802
8.2	.240711	.248985	.266830	.307282	.312672	.361664	.383622	.407762	.438600	.476532
8.3	.242985	.251259	.269004	.310424	.315342	.364910	.387172	.410812	.442241	.480262
8.4	.245259	.253533	.271178	.313568	.318012	.368156	.390722	.413862	.445882	.484000
8.5	.247533	.255807	.273352	.316712	.320672	.371402	.394272	.416912	.449523	.487732
8.6	.249807	.258081	.275526	.319857	.323322	.374648	.397822	.419962	.453164	.491462
8.7	.252081	.260355	.277700	.323002	.325972	.377894	.401372	.423012	.456805	.495192
8.8	.254355	.262629	.279874	.326146	.328622	.381140	.404922	.426062	.460446	.498922
8.9	.256629	.264903	.282048	.329290	.331272	.384402	.408472	.429112	.464087	.502652
9.0	.258903	.267177	.284222	.332434	.333922	.387662	.412022	.432162	.467728	.506382
9.1	.261177	.269451	.286396	.335578	.336572	.390922	.415572	.435212	.471369	.510112
9.2	.263451	.271725	.288570	.338722	.339222	.394178	.419122	.438312	.475010	.513842
9.3	.265725	.273999	.290744	.341866	.341872	.397434	.422672	.441362	.478651	.517572
9.4	.268000	.276273	.292918	.345010	.344522	.400690	.426222	.444412	.482292	.521302
9.5	.270274	.278547	.295092	.348154	.347172	.403946	.429772	.447462	.485933	.525032
9.6	.272548	.280821	.297266	.351298	.349822	.407202	.433322	.450512	.489574	.528762
9.7	.274822	.283095	.299440	.354442	.352472	.410458	.436872	.453562	.493215	.532492
9.8	.277096	.285369	.301614	.357586	.355122	.413714	.440422	.456612	.496856	.536222
9.9	.279370	.287643	.303788	.360730	.357772	.416970	.443972	.459662	.500497	.539952

Percentage Points of the χ^2 Distribution
 Values of χ^2 in Terms of Q and v

$v \backslash Q$	0.00000	0.00050	0.00100	0.00150	0.00200	0.00250	0.00300	0.00350	0.00400	0.00450	0.00500	0.00550	0.00600	0.00650	0.00700	0.00750	0.00800	0.00850	0.00900	0.00950	0.01000	
60.00	.64980	.64989	.64998	.65007	.65016	.65025	.65034	.65043	.65052	.65061	.65070	.65079	.65088	.65097	.65106	.65115	.65124	.65133	.65142	.65151	.65160	.65169
60.05	.65205	.65214	.65223	.65232	.65241	.65250	.65259	.65268	.65277	.65286	.65295	.65304	.65313	.65322	.65331	.65340	.65349	.65358	.65367	.65376	.65385	.65394
60.10	.65470	.65479	.65488	.65497	.65506	.65515	.65524	.65533	.65542	.65551	.65560	.65569	.65578	.65587	.65596	.65605	.65614	.65623	.65632	.65641	.65650	.65659
60.15	.65795	.65804	.65813	.65822	.65831	.65840	.65849	.65858	.65867	.65876	.65885	.65894	.65903	.65912	.65921	.65930	.65939	.65948	.65957	.65966	.65975	.65984
60.20	.66190	.66199	.66208	.66217	.66226	.66235	.66244	.66253	.66262	.66271	.66280	.66289	.66298	.66307	.66316	.66325	.66334	.66343	.66352	.66361	.66370	.66379
60.25	.66595	.66604	.66613	.66622	.66631	.66640	.66649	.66658	.66667	.66676	.66685	.66694	.66703	.66712	.66721	.66730	.66739	.66748	.66757	.66766	.66775	.66784
60.30	.66990	.66999	.67008	.67017	.67026	.67035	.67044	.67053	.67062	.67071	.67080	.67089	.67098	.67107	.67116	.67125	.67134	.67143	.67152	.67161	.67170	.67179
60.35	.67395	.67404	.67413	.67422	.67431	.67440	.67449	.67458	.67467	.67476	.67485	.67494	.67503	.67512	.67521	.67530	.67539	.67548	.67557	.67566	.67575	.67584
60.40	.67790	.67799	.67808	.67817	.67826	.67835	.67844	.67853	.67862	.67871	.67880	.67889	.67898	.67907	.67916	.67925	.67934	.67943	.67952	.67961	.67970	.67979
60.45	.68195	.68204	.68213	.68222	.68231	.68240	.68249	.68258	.68267	.68276	.68285	.68294	.68303	.68312	.68321	.68330	.68339	.68348	.68357	.68366	.68375	.68384
60.50	.68590	.68599	.68608	.68617	.68626	.68635	.68644	.68653	.68662	.68671	.68680	.68689	.68698	.68707	.68716	.68725	.68734	.68743	.68752	.68761	.68770	.68779
60.55	.68995	.68999	.69008	.69017	.69026	.69035	.69044	.69053	.69062	.69071	.69080	.69089	.69098	.69107	.69116	.69125	.69134	.69143	.69152	.69161	.69170	.69179
60.60	.69390	.69399	.69408	.69417	.69426	.69435	.69444	.69453	.69462	.69471	.69480	.69489	.69498	.69507	.69516	.69525	.69534	.69543	.69552	.69561	.69570	.69579
60.65	.69795	.69804	.69813	.69822	.69831	.69840	.69849	.69858	.69867	.69876	.69885	.69894	.69903	.69912	.69921	.69930	.69939	.69948	.69957	.69966	.69975	.69984
60.70	.70190	.70199	.70208	.70217	.70226	.70235	.70244	.70253	.70262	.70271	.70280	.70289	.70298	.70307	.70316	.70325	.70334	.70343	.70352	.70361	.70370	.70379
60.75	.70595	.70604	.70613	.70622	.70631	.70640	.70649	.70658	.70667	.70676	.70685	.70694	.70703	.70712	.70721	.70730	.70739	.70748	.70757	.70766	.70775	.70784
60.80	.70990	.70999	.71008	.71017	.71026	.71035	.71044	.71053	.71062	.71071	.71080	.71089	.71098	.71107	.71116	.71125	.71134	.71143	.71152	.71161	.71170	.71179
60.85	.71395	.71404	.71413	.71422	.71431	.71440	.71449	.71458	.71467	.71476	.71485	.71494	.71503	.71512	.71521	.71530	.71539	.71548	.71557	.71566	.71575	.71584
60.90	.71790	.71799	.71808	.71817	.71826	.71835	.71844	.71853	.71862	.71871	.71880	.71889	.71898	.71907	.71916	.71925	.71934	.71943	.71952	.71961	.71970	.71979
60.95	.72195	.72204	.72213	.72222	.72231	.72240	.72249	.72258	.72267	.72276	.72285	.72294	.72303	.72312	.72321	.72330	.72339	.72348	.72357	.72366	.72375	.72384
61.00	.72590	.72599	.72608	.72617	.72626	.72635	.72644	.72653	.72662	.72671	.72680	.72689	.72698	.72707	.72716	.72725	.72734	.72743	.72752	.72761	.72770	.72779

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

ν	.07500	.05000	.02500	.01000	.00500	.00100	.00050	.00010	.00005	.00001
112.5	152238 03	154880 03	159201 03	164590 03	168486 03	177001 03	180486 03	188242 03	191457 03	198679 03
113.0	152820 03	155466 03	159794 03	165201 03	169096 03	177624 03	181115 03	188883 03	192103 03	199337 03
113.5	153400 03	156052 03	160388 03	165800 03	169695 03	178248 03	181744 03	189524 03	192749 03	199994 03
114.0	153981 03	156637 03	160981 03	166406 03	170314 03	178871 03	182373 03	190165 03	193395 03	200650 03
114.5	154562 03	157223 03	161573 03	167008 03	170922 03	179493 03	183001 03	190805 03	194040 03	201363 03
115.0	155142 03	157808 03	162166 03	167610 03	171531 03	180116 03	183629 03	191446 03	194685 03	202086 03
115.5	155722 03	158392 03	162759 03	168212 03	172139 03	180738 03	184257 03	192085 03	195330 03	202810 03
116.0	156302 03	158977 03	163351 03	168813 03	172747 03	181360 03	184884 03	192725 03	195975 03	203534 03
116.5	156882 03	159562 03	163943 03	169415 03	173355 03	181982 03	185512 03	193364 03	196619 03	203929 03
117.0	157462 03	160146 03	164535 03	170016 03	173962 03	182603 03	186139 03	194003 03	197263 03	204583 03
117.5	158041 03	160730 03	165126 03	170616 03	174570 03	183224 03	186765 03	194642 03	197906 03	205238 03
118.0	158620 03	161314 03	165716 03	171217 03	175177 03	183845 03	187392 03	195280 03	198550 03	205892 03
118.5	159202 03	161898 03	166309 03	171817 03	175784 03	184466 03	188018 03	195918 03	199193 03	206545 03
119.0	159779 03	162481 03	166900 03	172418 03	176390 03	185086 03	188644 03	196556 03	199835 03	207199 03
119.5	160357 03	163065 03	167491 03	173019 03	176997 03	185706 03	189269 03	197194 03	200478 03	207852 03
120.0	160936 03	163648 03	168082 03	173617 03	177603 03	186326 03	189895 03	197831 03	201120 03	208504 03
120.5	161514 03	164231 03	168672 03	174217 03	178209 03	186946 03	190520 03	198468 03	201762 03	209157 03
121.0	162093 03	164814 03	169263 03	174816 03	178815 03	187565 03	191145 03	199105 03	202403 03	209809 03
121.5	162671 03	165397 03	169853 03	175416 03	179420 03	188184 03	191759 03	199741 03	203044 03	210461 03
122.0	163249 03	165980 03	170443 03	176014 03	180025 03	188803 03	192393 03	200377 03	203685 03	211112 03
122.5	163827 03	166562 03	171032 03	176613 03	180631 03	189422 03	193017 03	201013 03	204326 03	211763 03
123.0	164404 03	167144 03	171622 03	177212 03	181235 03	190040 03	193641 03	201649 03	204966 03	212414 03
123.5	164982 03	167726 03	172211 03	177810 03	181840 03	190658 03	194265 03	202284 03	205606 03	213065 03
124.0	165559 03	168308 03	172801 03	178408 03	182445 03	191276 03	194888 03	202919 03	206246 03	213715 03
124.5	166137 03	168890 03	173390 03	179006 03	183049 03	191894 03	195511 03	203554 03	206885 03	214365 03
125.0	166714 03	169471 03	173978 03	179604 03	183653 03	192511 03	196134 03	204188 03	207525 03	215015 03
125.5	167290 03	170053 03	174567 03	180202 03	184257 03	193129 03	196757 03	204822 03	208164 03	215664 03
126.0	167867 03	170634 03	175156 03	180799 03	184861 03	193746 03	197379 03	205456 03	208802 03	216313 03
126.5	168444 03	171215 03	175744 03	181396 03	185464 03	194362 03	198001 03	206090 03	209441 03	216962 03
127.0	169020 03	171796 03	176332 03	181993 03	186067 03	194979 03	198623 03	206724 03	210079 03	217610 03
127.5	169597 03	172377 03	176920 03	182590 03	186670 03	195595 03	199244 03	207357 03	210717 03	218258 03
128.0	170173 03	172957 03	177508 03	183186 03	187273 03	196211 03	199866 03	207990 03	211354 03	218906 03
128.5	170749 03	173538 03	178095 03	183783 03	187875 03	196827 03	200487 03	208622 03	211992 03	219554 03
129.0	171325 03	174118 03	178683 03	184379 03	188478 03	197443 03	201108 03	209255 03	212629 03	220201 03
129.5	171901 03	174700 03	179270 03	184975 03	189080 03	198058 03	201729 03	209887 03	213265 03	220848 03
130.0	172476 03	175276 03	179857 03	185571 03	189682 03	198673 03	202349 03	210519 03	213902 03	221495 03
130.5	173051 03	175858 03	180444 03	186167 03	190284 03	199280 03	202969 03	211150 03	214538 03	222142 03
131.0	173626 03	176436 03	181031 03	186762 03	190886 03	199903 03	203589 03	211782 03	215174 03	222788 03
131.5	174202 03	177017 03	181618 03	187357 03	191487 03	200518 03	204209 03	212413 03	215810 03	223434 03
132.0	174777 03	177597 03	182204 03	187953 03	192088 03	201132 03	204828 03	213044 03	216448 03	224079 03
132.5	175351 03	178176 03	182790 03	188548 03	192689 03	201746 03	205448 03	213674 03	217081 03	224725 03
133.0	175925 03	178755 03	183377 03	189142 03	193290 03	202360 03	206067 03	214305 03	217716 03	225370 03
133.5	176500 03	179334 03	183963 03	189737 03	193891 03	202973 03	206686 03	214935 03	218350 03	226015 03
134.0	177075 03	179913 03	184548 03	190331 03	194491 03	203587 03	207304 03	215565 03	218985 03	226659 03
134.5	177649 03	180491 03	185134 03	190926 03	195092 03	204200 03	207923 03	216194 03	219619 03	227304 03
135.0	178223 03	181070 03	185720 03	191520 03	195692 03	204813 03	208541 03	216824 03	220253 03	227948 03
135.5	178797 03	181648 03	186305 03	192113 03	196292 03	205426 03	209159 03	217453 03	220887 03	228592 03
136.0	179371 03	182226 03	186890 03	192707 03	196891 03	206039 03	209777 03	218082 03	221520 03	229235 03
136.5	179945 03	182804 03	187475 03	193301 03	197491 03	206651 03	210394 03	218711 03	222154 03	229878 03
137.0	180519 03	183382 03	188060 03	193894 03	198090 03	207263 03	211012 03	219339 03	222787 03	230521 03

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and p

p/Q	.607500	.605000	.602500	.601000	.600500	.600010	.000005	.000001
212.5	.265905 03	.269350 03	.274953 03	.281942 03	.286946 03	.312115 03	.316173 03	.325254 03
213.0	.266464 03	.269912 03	.275531 03	.282517 03	.287526 03	.312719 03	.316780 03	.325869 03
213.5	.267023 03	.270475 03	.276093 03	.283081 03	.288096 03	.313322 03	.317387 03	.326433 03
214.0	.267582 03	.271037 03	.276657 03	.283666 03	.288685 03	.313925 03	.317993 03	.327003 03
214.5	.268141 03	.271599 03	.277235 03	.284241 03	.289265 03	.314527 03	.318600 03	.327572 03
215.0	.268700 03	.272162 03	.277802 03	.284815 03	.289844 03	.315130 03	.319216 03	.328142 03
215.5	.269258 03	.272724 03	.278370 03	.285390 03	.290423 03	.315732 03	.319812 03	.328711 03
216.0	.269817 03	.273286 03	.278938 03	.285964 03	.291002 03	.316335 03	.320418 03	.329280 03
216.5	.270375 03	.273848 03	.279505 03	.286538 03	.291581 03	.316937 03	.321024 03	.329855 03
217.0	.270934 03	.274409 03	.280073 03	.287112 03	.292160 03	.317539 03	.321630 03	.330433 03
217.5	.271492 03	.274971 03	.280640 03	.287687 03	.292739 03	.318141 03	.322236 03	.331013 03
218.0	.272050 03	.275533 03	.281207 03	.288261 03	.293318 03	.318743 03	.322841 03	.331596 03
218.5	.272609 03	.276095 03	.281774 03	.288835 03	.293897 03	.319345 03	.323447 03	.332183 03
219.0	.273167 03	.276656 03	.282341 03	.289408 03	.294475 03	.319947 03	.324052 03	.332773 03
219.5	.273725 03	.277218 03	.282908 03	.289982 03	.295054 03	.320548 03	.324657 03	.333366 03
220.0	.274283 03	.277779 03	.283475 03	.290556 03	.295632 03	.321150 03	.325262 03	.333963 03
220.5	.274841 03	.278341 03	.284042 03	.291129 03	.296211 03	.321751 03	.325867 03	.334563 03
221.0	.275399 03	.278902 03	.284609 03	.291703 03	.296789 03	.322353 03	.326472 03	.335168 03
221.5	.275957 03	.279463 03	.285176 03	.292276 03	.297367 03	.322954 03	.327077 03	.335773 03
222.0	.276514 03	.280026 03	.285742 03	.292850 03	.297945 03	.323555 03	.327681 03	.336383 03
222.5	.277072 03	.280585 03	.286309 03	.293423 03	.298523 03	.324156 03	.328286 03	.336996 03
223.0	.277630 03	.281146 03	.286875 03	.293996 03	.299101 03	.324756 03	.328890 03	.337613 03
223.5	.278187 03	.281707 03	.287442 03	.294569 03	.299679 03	.325357 03	.329495 03	.338233 03
224.0	.278745 03	.282268 03	.288008 03	.295142 03	.300257 03	.325958 03	.330099 03	.338856 03
224.5	.279302 03	.282829 03	.288575 03	.295715 03	.300834 03	.326558 03	.330703 03	.339483 03
225.0	.279860 03	.283390 03	.289141 03	.296288 03	.301412 03	.327159 03	.331307 03	.340113 03
225.5	.280417 03	.283951 03	.289707 03	.296861 03	.301989 03	.327759 03	.331910 03	.340747 03
226.0	.280974 03	.284511 03	.290273 03	.297433 03	.302567 03	.328359 03	.332514 03	.341383 03
226.5	.281531 03	.285072 03	.290839 03	.298006 03	.303144 03	.328959 03	.333118 03	.342020 03
227.0	.282088 03	.285632 03	.291405 03	.298579 03	.303721 03	.329559 03	.333721 03	.342660 03
227.5	.282646 03	.286193 03	.291971 03	.299151 03	.304298 03	.330159 03	.334324 03	.343304 03
228.0	.283203 03	.286753 03	.292536 03	.299723 03	.304875 03	.330758 03	.334928 03	.343953 03
228.5	.283760 03	.287313 03	.293122 03	.300296 03	.305452 03	.331358 03	.335531 03	.344606 03
229.0	.284317 03	.287874 03	.293708 03	.300868 03	.306029 03	.331957 03	.336134 03	.345263 03
229.5	.284873 03	.288434 03	.294293 03	.301440 03	.306606 03	.332557 03	.336737 03	.345923 03
230.0	.285430 03	.288995 03	.294879 03	.302012 03	.307183 03	.333156 03	.337339 03	.346586 03
230.5	.285987 03	.289556 03	.295464 03	.302584 03	.307759 03	.333755 03	.337942 03	.347253 03
231.0	.286543 03	.290117 03	.296049 03	.303156 03	.308336 03	.334354 03	.338545 03	.347923 03
231.5	.287100 03	.290678 03	.296634 03	.303728 03	.308912 03	.334953 03	.339147 03	.348596 03
232.0	.287656 03	.291239 03	.297219 03	.304299 03	.309488 03	.335552 03	.339749 03	.349273 03
232.5	.288213 03	.291800 03	.297805 03	.304871 03	.310065 03	.336151 03	.340352 03	.349953 03
233.0	.288770 03	.292361 03	.298391 03	.305443 03	.310641 03	.336749 03	.340954 03	.350637 03
233.5	.289327 03	.292922 03	.298977 03	.306014 03	.311217 03	.337348 03	.341556 03	.351323 03
234.0	.289884 03	.293483 03	.299563 03	.306586 03	.311793 03	.337946 03	.342158 03	.352013 03
234.5	.290441 03	.294044 03	.299985 03	.307157 03	.312369 03	.338545 03	.342759 03	.352706 03
235.0	.290998 03	.294605 03	.300499 03	.307728 03	.312942 03	.339144 03	.343361 03	.353403 03
235.5	.291555 03	.295166 03	.301012 03	.308299 03	.313515 03	.339743 03	.343963 03	.354103 03
236.0	.292112 03	.295727 03	.301526 03	.308860 03	.314086 03	.340341 03	.344564 03	.354806 03
236.5	.292669 03	.296288 03	.302039 03	.309421 03	.314657 03	.340939 03	.345166 03	.355513 03
237.0	.293226 03	.296849 03	.302552 03	.310013 03	.315228 03	.341537 03	.345767 03	.356223 03

Percentage Points of the χ^2 - Distribution
Values of χ^2 in Terms of Q and ν

Q	ν	.95	.90	.80	.70	.60	.50	.40	.30	.20	.10	.05	.01
37.3	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
37.4	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
37.5	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
37.6	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
37.7	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
37.8	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
37.9	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.0	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.1	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.2	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.3	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.4	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.5	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.6	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.7	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.8	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
38.9	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.0	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.1	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.2	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.3	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.4	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.5	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.6	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.7	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.8	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
39.9	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791
40.0	1	4.0150	4.6051	5.0249	5.4010	5.7559	6.0798	6.3778	6.6579	6.9248	7.1781	7.4278	7.8791

Percentage Points of the χ^2 -Distribution
Values of χ^2 in Terms of Q and ν

ν	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.50	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	15.00	20.00	25.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00																																																								
1	3.84	2.71	2.00	1.64	1.39	1.20	1.08	1.00	0.94	0.89	0.85	0.81	0.78	0.75	0.73	0.71	0.69	0.68	0.67	0.66	0.65	0.64	0.63	0.62	0.61	0.60	0.59	0.58	0.57	0.56	0.55	0.54	0.53	0.52	0.51	0.50																																																				
2	5.99	4.61	3.84	3.22	2.77	2.45	2.20	2.00	1.85	1.73	1.64	1.58	1.53	1.49	1.46	1.44	1.42	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.32	1.31	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.23	1.22	1.21	1.20																																																	
3	7.88	6.25	5.02	4.41	3.94	3.58	3.28	3.04	2.84	2.69	2.58	2.51	2.46	2.42	2.39	2.37	2.36	2.35	2.34	2.33	2.32	2.31	2.30	2.29	2.28	2.27	2.26	2.25	2.24	2.23	2.22	2.21	2.20	2.19	2.18	2.17	2.16	2.15	2.14	2.13																																																
4	9.49	7.78	6.37	5.79	5.31	4.94	4.63	4.41	4.21	4.05	3.93	3.86	3.81	3.77	3.74	3.72	3.71	3.70	3.69	3.68	3.67	3.66	3.65	3.64	3.63	3.62	3.61	3.60	3.59	3.58	3.57	3.56	3.55	3.54	3.53	3.52	3.51	3.50	3.49	3.48	3.47	3.46																																														
5	11.07	9.35	7.78	7.21	6.71	6.33	6.01	5.78	5.58	5.41	5.28	5.21	5.16	5.12	5.09	5.07	5.06	5.05	5.04	5.03	5.02	5.01	5.00	4.99	4.98	4.97	4.96	4.95	4.94	4.93	4.92	4.91	4.90	4.89	4.88	4.87	4.86	4.85	4.84	4.83	4.82	4.81	4.80																																													
6	12.59	10.80	9.15	8.59	8.07	7.67	7.34	7.11	6.90	6.73	6.59	6.51	6.46	6.42	6.39	6.37	6.36	6.35	6.34	6.33	6.32	6.31	6.30	6.29	6.28	6.27	6.26	6.25	6.24	6.23	6.22	6.21	6.20	6.19	6.18	6.17	6.16	6.15	6.14	6.13	6.12	6.11	6.10	6.09	6.08	6.07																																										
7	14.07	12.19	10.42	9.87	9.34	8.92	8.58	8.34	8.12	7.94	7.79	7.70	7.65	7.61	7.58	7.56	7.55	7.54	7.53	7.52	7.51	7.50	7.49	7.48	7.47	7.46	7.45	7.44	7.43	7.42	7.41	7.40	7.39	7.38	7.37	7.36	7.35	7.34	7.33	7.32	7.31	7.30	7.29	7.28	7.27	7.26	7.25	7.24	7.23	7.22	7.21	7.20																																				
8	15.51	13.58	11.70	11.16	10.62	10.19	9.83	9.58	9.35	9.15	8.98	8.88	8.83	8.79	8.76	8.74	8.73	8.72	8.71	8.70	8.69	8.68	8.67	8.66	8.65	8.64	8.63	8.62	8.61	8.60	8.59	8.58	8.57	8.56	8.55	8.54	8.53	8.52	8.51	8.50	8.49	8.48	8.47	8.46	8.45	8.44	8.43	8.42	8.41	8.40	8.39	8.38	8.37	8.36	8.35	8.34	8.33	8.32	8.31	8.30																												
9	16.92	14.94	13.02	12.49	11.94	11.50	11.13	10.87	10.63	10.42	10.24	10.13	10.08	10.04	10.01	9.99	9.98	9.97	9.96	9.95	9.94	9.93	9.92	9.91	9.90	9.89	9.88	9.87	9.86	9.85	9.84	9.83	9.82	9.81	9.80	9.79	9.78	9.77	9.76	9.75	9.74	9.73	9.72	9.71	9.70	9.69	9.68	9.67	9.66	9.65	9.64	9.63	9.62	9.61	9.60	9.59	9.58	9.57	9.56	9.55	9.54	9.53	9.52	9.51	9.50																							
10	18.31	16.34	14.33	13.80	13.25	12.80	12.42	12.15	11.90	11.68	11.49	11.37	11.31	11.27	11.24	11.22	11.21	11.20	11.19	11.18	11.17	11.16	11.15	11.14	11.13	11.12	11.11	11.10	11.09	11.08	11.07	11.06	11.05	11.04	11.03	11.02	11.01	11.00	10.99	10.98	10.97	10.96	10.95	10.94	10.93	10.92	10.91	10.90	10.89	10.88	10.87	10.86	10.85	10.84	10.83	10.82	10.81	10.80	10.79	10.78	10.77	10.76	10.75	10.74	10.73	10.72	10.71	10.70	10.69	10.68	10.67	10.66	10.65	10.64	10.63	10.62	10.61	10.60	10.59	10.58	10.57	10.56	10.55	10.54	10.53	10.52	10.51	10.50

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and p

Q	p	0.0100	0.0250	0.0500	0.1000	0.2000	0.3000	0.4000	0.5000	0.6000	0.7000	0.8000	0.9000	0.9500	0.9750	0.9900	0.9950	0.9990
1.0	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.0500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.2000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.3000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.4000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.6000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.7000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.8000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.9000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.9500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.9750	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.9900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.9950	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.0	0.9990	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and P

Q	18.0000	18.5000	19.0000	19.5000	20.0000	20.5000	21.0000	21.5000	22.0000	22.5000	23.0000	23.5000	24.0000	24.5000	25.0000	25.5000	26.0000	26.5000	27.0000	27.5000	28.0000	28.5000	29.0000	29.5000	30.0000		
.00	18.475	18.980	19.485	19.990	20.495	21.000	21.505	22.010	22.515	23.020	23.525	24.030	24.535	25.040	25.545	26.050	26.555	27.060	27.565	28.070	28.575	29.080	29.585	30.090	30.595		
.01	18.500	19.005	19.510	20.015	20.520	21.025	21.530	22.035	22.540	23.045	23.550	24.055	24.560	25.065	25.570	26.075	26.580	27.085	27.590	28.095	28.600	29.105	29.610	30.115	30.620	31.125	
.02	18.525	19.030	19.535	20.040	20.545	21.050	21.555	22.060	22.565	23.070	23.575	24.080	24.585	25.090	25.595	26.100	26.605	27.110	27.615	28.120	28.625	29.130	29.635	30.140	30.645	31.150	31.655
.03	18.550	19.055	19.560	20.065	20.570	21.075	21.580	22.085	22.590	23.095	23.600	24.105	24.610	25.115	25.620	26.125	26.630	27.135	27.640	28.145	28.650	29.155	29.660	30.165	30.670	31.175	31.680
.04	18.575	19.080	19.585	20.095	20.600	21.105	21.610	22.115	22.620	23.125	23.630	24.135	24.640	25.145	25.650	26.155	26.660	27.165	27.670	28.175	28.680	29.185	29.690	30.200	30.705	31.210	31.715
.05	18.600	19.105	19.610	20.120	20.625	21.130	21.635	22.140	22.645	23.150	23.655	24.160	24.665	25.170	25.675	26.180	26.685	27.190	27.695	28.200	28.705	29.210	29.715	30.220	30.725	31.230	31.735
.06	18.625	19.130	19.635	20.145	20.660	21.165	21.670	22.175	22.680	23.185	23.690	24.195	24.700	25.205	25.710	26.215	26.720	27.225	27.730	28.235	28.740	29.240	29.745	30.250	30.755	31.260	31.765
.07	18.650	19.155	19.660	20.170	20.685	21.190	21.695	22.200	22.705	23.210	23.715	24.220	24.725	25.230	25.735	26.240	26.745	27.250	27.755	28.260	28.765	29.270	29.775	30.280	30.785	31.290	31.795
.08	18.675	19.180	19.685	20.195	20.710	21.215	21.720	22.225	22.730	23.235	23.740	24.245	24.750	25.255	25.760	26.260	26.765	27.270	27.775	28.280	28.785	29.290	29.795	30.300	30.805	31.300	31.805
.09	18.700	19.205	19.710	20.220	20.735	21.240	21.745	22.240	22.745	23.250	23.755	24.255	24.760	25.265	25.770	26.270	26.775	27.280	27.785	28.290	28.795	29.300	29.805	30.310	30.815	31.310	31.815
.10	18.725	19.230	19.735	20.245	20.760	21.265	21.770	22.260	22.765	23.265	23.760	24.265	24.765	25.270	25.775	26.275	26.780	27.285	27.790	28.295	28.800	29.310	29.815	30.320	30.820	31.320	31.820

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of α and ν

α	ν	χ^2	α	ν	χ^2	α	ν	χ^2
.0005	1	3.84146	.0005	1	3.84146	.0005	1	3.84146
.0005	2	7.37778	.0005	2	7.37778	.0005	2	7.37778
.0005	3	9.34840	.0005	3	9.34840	.0005	3	9.34840
.0005	4	10.62138	.0005	4	10.62138	.0005	4	10.62138
.0005	5	11.98855	.0005	5	11.98855	.0005	5	11.98855
.0005	6	13.20204	.0005	6	13.20204	.0005	6	13.20204
.0005	7	14.26704	.0005	7	14.26704	.0005	7	14.26704
.0005	8	15.15222	.0005	8	15.15222	.0005	8	15.15222
.0005	9	15.90170	.0005	9	15.90170	.0005	9	15.90170
.0005	10	16.53669	.0005	10	16.53669	.0005	10	16.53669
.0005	11	17.07484	.0005	11	17.07484	.0005	11	17.07484
.0005	12	17.53457	.0005	12	17.53457	.0005	12	17.53457
.0005	13	17.91912	.0005	13	17.91912	.0005	13	17.91912
.0005	14	18.22972	.0005	14	18.22972	.0005	14	18.22972
.0005	15	18.47562	.0005	15	18.47562	.0005	15	18.47562
.0005	16	18.65053	.0005	16	18.65053	.0005	16	18.65053
.0005	17	18.75947	.0005	17	18.75947	.0005	17	18.75947
.0005	18	18.80624	.0005	18	18.80624	.0005	18	18.80624
.0005	19	18.81707	.0005	19	18.81707	.0005	19	18.81707
.0005	20	18.79276	.0005	20	18.79276	.0005	20	18.79276
.0005	21	18.73982	.0005	21	18.73982	.0005	21	18.73982
.0005	22	18.66503	.0005	22	18.66503	.0005	22	18.66503
.0005	23	18.56591	.0005	23	18.56591	.0005	23	18.56591
.0005	24	18.43998	.0005	24	18.43998	.0005	24	18.43998
.0005	25	18.28364	.0005	25	18.28364	.0005	25	18.28364
.0005	26	18.09437	.0005	26	18.09437	.0005	26	18.09437
.0005	27	17.87016	.0005	27	17.87016	.0005	27	17.87016
.0005	28	17.61045	.0005	28	17.61045	.0005	28	17.61045
.0005	29	17.31526	.0005	29	17.31526	.0005	29	17.31526
.0005	30	16.99270	.0005	30	16.99270	.0005	30	16.99270
.0005	31	16.64142	.0005	31	16.64142	.0005	31	16.64142
.0005	32	16.26041	.0005	32	16.26041	.0005	32	16.26041
.0005	33	15.85009	.0005	33	15.85009	.0005	33	15.85009
.0005	34	15.41112	.0005	34	15.41112	.0005	34	15.41112
.0005	35	14.95441	.0005	35	14.95441	.0005	35	14.95441
.0005	36	14.48114	.0005	36	14.48114	.0005	36	14.48114
.0005	37	13.99272	.0005	37	13.99272	.0005	37	13.99272
.0005	38	13.49075	.0005	38	13.49075	.0005	38	13.49075
.0005	39	12.97603	.0005	39	12.97603	.0005	39	12.97603
.0005	40	12.45045	.0005	40	12.45045	.0005	40	12.45045
.0005	41	11.91511	.0005	41	11.91511	.0005	41	11.91511
.0005	42	11.37113	.0005	42	11.37113	.0005	42	11.37113
.0005	43	10.82072	.0005	43	10.82072	.0005	43	10.82072
.0005	44	10.26518	.0005	44	10.26518	.0005	44	10.26518
.0005	45	9.70590	.0005	45	9.70590	.0005	45	9.70590
.0005	46	9.14438	.0005	46	9.14438	.0005	46	9.14438
.0005	47	8.58219	.0005	47	8.58219	.0005	47	8.58219
.0005	48	8.02084	.0005	48	8.02084	.0005	48	8.02084
.0005	49	7.46094	.0005	49	7.46094	.0005	49	7.46094
.0005	50	6.90309	.0005	50	6.90309	.0005	50	6.90309

APPENDIX B
TABLE B
PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION (Condensed)

PERCENTAGE POINTS OF $Q(\nu|\chi^2)$ – CONDENSED TABLE B

In this appendix, we give a condensed version of the table in Appendix A. The values of Q and ν are taken from the table given in [1, pp. 984-985]. There are numerous errors in that table. One of the largest occurs for $\nu = 7, Q = .995$. They give $\chi^2 = .989265$ instead of a correct value of $\chi^2 = .989256$.

The values of χ^2 are given to seven correct significant digits in Table B.

Percentage Points of the χ^2 Distribution
Values of χ^2 in Terms of Q and r

	.995	.975	.950	.900	.750	.500	.250
1	.000153	.000307	.000451	.000763	.001145	.001734	.002632
2	.010001	.019778	.029353	.048352	.071721	.103973	.148602
3	.020301	.037673	.054287	.085398	.121253	.167654	.228325
4	.030853	.053988	.076328	.114599	.162559	.225371	.308292
5	.041512	.069580	.095424	.143009	.204603	.285146	.391904
6	.052262	.082137	.108851	.161030	.235459	.334121	.460804
7	.063093	.096479	.125001	.182043	.265452	.384581	.523748
8	.073997	.111591	.141853	.207580	.294640	.437421	.591895
9	.084967	.127481	.158585	.235113	.323327	.493233	.665259
10	.095995	.144159	.176687	.262112	.351920	.531160	.744868
11	.107084	.161634	.196701	.287785	.380943	.573100	.830692
12	.118227	.179917	.218029	.311236	.410143	.618400	.923866
13	.129427	.198020	.240681	.336191	.439796	.667376	.102450
14	.140686	.216964	.264553	.361802	.469066	.719397	.111693
15	.151997	.236758	.289844	.388076	.498001	.773866	.121450
16	.163362	.257414	.316461	.415801	.526643	.831350	.131722
17	.174784	.278953	.346381	.445049	.555151	.891896	.142518
18	.186265	.301394	.377944	.475826	.584581	.955543	.153850
19	.197807	.324758	.411244	.508149	.614981	.102450	.165737
20	.209411	.349064	.449601	.543602	.646481	.113370	.178181
21	.221078	.374333	.490244	.581249	.679126	.124426	.191211
22	.232809	.400587	.533301	.621102	.712961	.135633	.204848
23	.244605	.427847	.587901	.663449	.748026	.147001	.219102
24	.256467	.456133	.645181	.708202	.784361	.158533	.233985
25	.268395	.485474	.704461	.756366	.821926	.170233	.249497
26	.280389	.515891	.762381	.811302	.860761	.182101	.265648
27	.292449	.547414	.818961	.868102	.900926	.194133	.282448
28	.304575	.580064	.876401	.927466	.942461	.206333	.299902
29	.316767	.613861	.934661	.989466	.985426	.218701	.318026
30	.329025	.648826	.993761	1.054066	1.029861	.231233	.336826
31	.341349	.684981	1.054761	1.121302	1.075766	.243933	.356302
32	.353739	.722344	1.116101	1.180602	1.123061	.256701	.376466
33	.366195	.760944	1.178161	1.242802	1.171766	.269633	.397302
34	.378717	.800801	1.240961	1.308002	1.221926	.282733	.418826
35	.391305	.841944	1.305461	1.376202	1.273601	.296001	.441066
36	.403959	.884381	1.371761	1.447466	1.326866	.309433	.464026
37	.416679	.928144	1.439901	1.521802	1.381766	.323033	.487702
38	.429465	.973261	1.509761	1.599202	1.438301	.336801	.512102
39	.442317	1.019761	1.581961	1.679702	1.496466	.350733	.537226
40	.455235	1.067661	1.656461	1.763402	1.556266	.364833	.563066
41	.468219	1.116981	1.733301	1.850302	1.617701	.379083	.589626
42	.481269	1.167744	1.812501	1.940502	1.680866	.393483	.616926
43	.494395	1.219981	1.894101	2.034102	1.745766	.408033	.644966
44	.507587	1.273726	1.978161	2.131202	1.812466	.422733	.673726
45	.520845	1.329001	2.064661	2.231802	1.880966	.437583	.703202
46	.534169	1.385844	2.153661	2.336002	1.951301	.452583	.733402
47	.547559	1.444281	2.245161	2.443802	2.023566	.467733	.764326
48	.561015	1.504344	2.339261	2.555302	2.097766	.483033	.795966
49	.574537	1.566061	2.435961	2.670502	2.173901	.498483	.828326
50	.588125	1.629461	2.535261	2.789402	2.252066	.514083	.861426

APPENDIX C
PROGRAM LISTING - GAMINV

GAMINV - PROGRAM LISTING FOR COMPUTING x FROM THE INCOMPLETE GAMMA FUNCTION RATIOS AND a

Purpose

This subroutine, for a given P , Q and a , is used to find the x value for which

$$P = \frac{\int_0^x e^{-t} t^{a-1} dt}{\int_0^{\infty} e^{-t} t^{a-1} dt}, \quad a > 0, \quad x \geq 0$$

$$Q = 1 - P$$

Calling Sequence

Call GAMINV ($a, x, x_0, P, Q, IERR$)

where a, x, P, Q are as above x_0 is an optional input starting value. x_0 must be set to zero if user does not want to specify a starting value. IERR is a parameter set by GAMINV. Normally IERR is an integer from 1 to 19 which denotes the number of iterations the Newton-Raphson method has taken to compute the x value. IERR is stored in Y (See page 10).

IERR = 0 when either $a = 1$ or $a < 1$ with $Q\Gamma(a) \geq .45$ and $\{(ax)/(1+a)\} < 10^{-14}$, or $P = 1, Q = 0$ or $P = 0, Q = 1$. In every case an acceptable value of x is given

IERR = - 2 when $a \leq 0$. No x value is given.

IERR = - 4 when $|P + Q - 1| > 5 \cdot 10^{-13}$. No x value is given.

IERR = - 5 when $x_0 < 0$. No x value is given.

IERR = - 6 when the Newton-Raphson method has taken 20 iterations to compute the x value. The x value is given but may not be very accurate.

IERR = - 7 when user has specified a poor input starting value. A subsequent x_0 of the Newton-Raphson method is negative. No x value is given.

Termination procedure The routine uses the Newton-Raphson method and terminates when $n = 20$ (which should never occur) or when

$$|x_{n+1} - x_n| < 5 \times 10^{-8} x_{n+1} \quad n \leq 19$$

and one of two other inequalities (38) or (39) are satisfied. If (38) or (39) is not satisfied one more iteration is done.

Accuracy: One can expect about 8 correct significant digits in the output value of x . This can be improved by another call to the routine with that x specified as x_0 .

Restrictions: $a > 0$, $x_0 \geq 0$

If $P = 0$ and $Q = 1$ then $x = 0$ is returned.

If $P = 1$ and $Q = 0$ then $x = 10^{320}$ is returned $|P + Q - 1| \leq 5 \cdot 10^{-13}$.

Remark: GAMINV uses 3 subroutines, PAX6, EVA and GAMCØ3.

Program Listing - GAMINV

```

SJJROJTIME GAMINV ( A,XNP1,S3,PI,QI,IT )
DIMENSION C2(4)
DATA ( C2(I),I=1,4 ) / .15, .05, .01, .001 /
DATA RT2/1.4142 13562 37310/,ALAM/5.E-5/,TALAM/1.E-4/,EPS/1.E-5/,
1 EPS3/1.E-14/,EPS1/5.E-13/,J/0/
XNP1=C.
IT=0
IF ( PI.EQ.0..AND.QI.EQ.1. ) RETURN
IF ( PI.NE.1..OR .QI.NE.0. ) GO TO 2011
XNP1=1.E+320
RETURN
2011 CONTINUE
IF ( A.GT.J. ) GO TO 2:15
IT=-2
RETRN
2J15 CONTINUE
IF ( ABS(PI+QI-1.) .LE.EPS1 ) GO TO 2:17
IT=-4
RETURN
2J17 CONTINUE
IF ( S3.GE.0. ) GO TO 2J41
IT=-5
RETURN
2041 CONTINUE
IF ( A.NE.1. ) GO TO 2:51
XNP1=-ALOG(QI)
RETRN
2051 CONTINUE
IF ( S3.EQ.0. ) GO TO 3312
XN=S3
IF ( PI.LE.0.5 ) GO TO 3017
GO TO 3317
3011 CONTINUE
T3=1./A
AP=(PI+A*T3)**(T3)
X4=AP/(1.-AP/(A+1.))
T3=(XN*A)/(A+1.)
XNP1=XN
IF ( T3.LT.EPS3 ) RETURN
IF ( XN.LE.0.57 ) GO TO 3015
B1LN=ALOG(B1)
A3=A-1.
T1=-B1LN+A3*ALOG(-B1LN)
X4=-B1LN-(-A3)*ALOG(T1)-ALOG( (T1+2.-A)/(T1+1.) )
XN=AMAX1(XN,X4)
3015 CONTINUE
IF ( PI.GT.0.5 ) GO TO 3317
3017 CONTINUE
IT=J
3021 CONTINUE
CALL PAX6 ( A,XN,P,Q,J,R )
IF ( P.GT.1. ) GO TO 9071
IF ( P.EQ.0..OR.Q.EQ.0. ) GO TO 9071
XNP1=XN*(1.-(P-PI)/R)
IT=IT+1

```


Program Listing - GAMINV

```

IF ( IT.GE.20 ) GO TO 3039
T1=ABS(XNP1-XN)
IF ( T1 .GT.(ALAM*XNP1)) GO TO 3031
T1=T1*T1
IF ( A.LE.(XNP1-1.) ) GO TO 3028
AP1=A+1.
T3=T1*(AP1-XNP1)*ABS(A-XNP1-1.)
T5=(TALAM*XNP1*XNP1*AP1)/A
IF ( T3.LE.T5 ) RETURN
GO TO 3029
3028 CONTINUE
T3=T1*(XNP1+1.-A)*(XNP1+2.-A)
T5=TALAM*XNP1*(XNP1+1.)
IF ( T3.LE.T5 ) RETURN
3029 CONTINUE
CALL PAX6 ( A,XNP1,P,Q,J,R )
IF ( P.GT.1. ) GO TO 3071
IF ( R.EQ.0. ) CALL EVA(A,XNP1,R )
XN=XNP1
XNP1=XNP1*(1.-(P-PI)/R)
IT=IT+1
IF ( IT.GE.2. ) GO TO 3039
RETURN
3071 CONTINUE
XN=XNP1
GO TO 3021
3312 CONTINUE
IF ( A.GT.1. ) GO TO 3331
CALL GAMCO3 ( A,H,EPS,T5 )
B1=QI*T5
IF ( B1.GE.0.4 ) GO TO 3011
B1LN=ALOG(B1)
A3=A-1.
T1=-B1LN+A3*ALOG(-B1LN)
XN=-B1LN-(-A3)*ALOG(T1)-ALOG( (T1+2.-A)/(T1+1.) )
IF ( XN.GE.0.67 ) GO TO 3316
T3=1./A
AP=(PI*A*T5)**(T3)
XM=AP/(1.-AP/(A+1.))
XN=AMAX1(XN,XM)
3316 CONTINUE
IF ( PI.LE.0.5 ) GO TO 3017
3317 CONTINUE
IT=0
3321 CONTINUE
CALL PAX6 ( A,XN,P,Q,J,R )
IF ( P.GT.1. ) GO TO 9071
IF ( P.EQ.0..OR.Q.EQ.0. ) GO TO 9071
XNP1=XN*(1.+(Q-QI)/R)
IT=IT+1
IF ( IT.GE.20 ) GO TO 3009
T1=ABS(XNP1-XN)
IF ( T1 .GT.(ALAM*XNP1)) GO TO 3331
T1=T1*T1
IF ( A.LE.(XNP1-1.) ) GO TO 3325

```

Program Listing - GAMINV

```

AP1=A+1.
T3=T1*(AP1-XNP1)*ABS(A-XNP1-1.)
T3=(TALAM*XNP1*XNP1*AP1)/A
IF ( T3.LE.T5 ) RETURN
GO TO J327
3325 CONTINUE
T3=T1*(XNP1+1.-A)*(XNP1+2.-A)
T5=TALAM*XNP1*(XNP1+1.)
IF ( T3.LE.T5 ) RETURN
3327 CONTINUE
CALL PAX6 ( A,XNP1,P,Q,J,R )
IF ( P.GT.1. ) GO TO 3071
IF ( R.EQ.0. ) CALL EVA ( A,XNP1,R )
XN=XNP1
XNP1=XNP1*(1.+(Q-Q1)/R)
IT=IT+1
IF ( IT.GE.20 ) GO TO 30J9
RETURN
3331 CONTINUE
XN=XNP1
GO TO 3321
5331 CONTINUE
P=PI
Q=2I
IF ( Q1.GT.0.5 ) T=SQRT(-2.*ALOG(PI) )
IF ( Q1.LE.0.5 ) T=SQRT( -2.*ALOG(Q1) )
XP=T+((( -21352 34937 15827*T-4.253, 21559 6714)*T
1      -11.661 67202 88968)*T-3.3112 53221 08741)/
1      (((.36117 08101 894202-1*T+1.2736 44897 82223)*T
1      +5.4069 15977 63039)*T+6.0105 37656 25462)*T+1.)
IF ( PI.LE.0.5 ) XP=-XP
XPSQ=XP*XP
G1=XP*RT2
G2=.66566 66666 66667*(XPSQ-1. )
XPC3=XPSQ*XP
G3=(XP(3-7.*XP)/(9.*RT2)
XP4TH=XPC3*XP
G4=-((5.*XP4TH+14.*XPSQ-32.)/435.
G5=(9.*XP4TH*XP+256.*XPC3-433.*XP)/(4860.*RT2)
T1=2.*A
RT2A=SQRT(T1)
XV=.5*( T1 +G1*RT2A+G2+G3/RT2A+G4/ T1 +G5/(T1*RT2A))
IF ( PI.GT.0.5 ) GO TO 5471
IF ( A.GT.19. ) GO TO 3017
IF ( XN.GT.(.11 *(A+1.))) GO TO 3017
IF ( A.GT.4. ) GO TO 5469
APP5=A+.5
L3=INT(APP5)
IF ( PI.GT.C2(L3) ) GO TO 3017
5469 CONTINUE
CALL GAMCO3 ( A,M,EP5,T1 )
T3=1./A
X5=(PI*A*T1)**(T3)
T3=SQRT(1.-(4.*X5)/(A+1. ) )
XN=(2.*X5)/(1.+T3 )

```

Program Listing - GAMINV

```
GO TO 3917
5471 CONTINUE
      IF ( A.GE.11.0 ) GO TO 3317
      IF ( XN.LE.(4.8*A) ) GO TO 3317
      CALL GAMCO3 ( A,H,EPS,T1 )
      B1=21*T1
      B1LN=ALOG(B1)
      XN=-B1LN-(1.-1)*ALOG(XN)-ALOG((XN +2.-A)/(XN+1.))
      GO TO 3317
9009 CONTINUE
      IT=-6
      RETURN
9071 CONTINUE
      IT=-7
      XNPI=XN
      RETURN
      END
```

Program Listing - GAMINV

```

          SJ3ROJTIME PAX6 ( A,X,AYS,JAHS,IOP3,P )
          DIMENSION VA(20),VB(20),ZA(30),ZB(30),SA(20),SB(20)
9.  FORMAT ( 1HU,3H A= ,E22.14,3H X= ,E22.14 )
91  FORMAT ( 15H INPUT ERROR )
          DATA
1  P0/2.4266 79552 35532 E+2 /,
2  P1/2.1979 26161 82942 E+1 /,
3  P2/6.9963 83448 61914 E+0 /,
4  P3/-3.5609 84370 18154 E-2 /,
5  P4/2.1505 88758 65861 E+2 /,
6  Q1/9.1164 90540 45149 E+1 /,
7  Q2/1.5082 79763 04076 E+1 /,
8  Q3/1. /,
9  C0/3.5045 92610 24162 E+2 /
          DATA
1  C1/4.5151 89537 11873 E+2 /,
2  C2/3.3932 09107 34344E+2 /,
3  C3/1.5298 92850 46940 E+2 /,
4  C4/4.3162 22722 20567 E+1 /,
5  C5/7.2117 58250 80359 E+0 /,
6  C6/5.5419 55174 78974 E-1 /,
7  C7/-1.3086 4857 3 82717E-7 /,
8  ALPH0/-2.9961 07077 13542 E-3/,
9  ALPH1/-4.9473 09106 23251 E-2 /
          DATA
1  ALPH2/-2.2695 05935 39087 E-1 /,
2  ALPH3/-2.7866 13046 09648 E-1 /,
3  ALPH4/-2.2319 24597 34185 E-2 /,
4  BET0/1.0620 923.5 28469 E-2 /,
5  BET1/1.9130 83261 67830 E-1 /,
6  BET2/1.0516 75107 06793 /,
7  BET3/1.9973 32010 17135 /,
8  BET4/1. /,
9  D1/3.0045 92619 50993 E+2 /
          DATA
1  D1/7.9095 09253 27898 E+2 /,
2  D2/3.3135 40948 50610 E+2 /,
3  D3/6.3899 32644 65631 E+2 /,
4  D4/2.7758 54447 43988 E+2 /,
5  D5/7.7000 15293 52295 E+1 /,
6  D6/1.2782 72731 90294 E+1 /,
7  D7/1. /
C          SST2=SP(OP3+13./OP13936 80. )
C          SST3=SP(OP3+1733./OP21155 3920. )
C          SST4=SP(OP11388 8261./OP50791 58784 0. )
C          SST5=SP(OP75652 02533./OP78364 1649 50. )
          DATA
1  CST5/.16539 65736 46935E-3 /,
2  CST6/.72422 66600 50012E-2 /,
3  CST7/.17947 20737 75593E-2 /,
4  CST8/.24384 14494 74166E-2 /,
5  G44013/1.7724 53850 90592 /,
6  R12PI/2.5065 28274 63100 /,
7, R13PI/1.7724 53850 90592 /
          DATA
          DACC1/5.E-13/,ACC3/3.E-7/,ALPHA3/4.892/,

```

Program Listing - GAMINV

```

1     ALPHA1/7.3+86/,ACO/1.      /,
1     XJ1/31.000/,X03/17.00/,CEP/2.3025 85092 99405/
2     ,UX1/1.0366/,UX3/2.92+5/
3     ,RT2/.1+142 13562 37310E+1/,A9A2/100./
4     ,ALPHA5/3.29053/,X.5/9.7/,JX5/3.887/,ACC5/5.E-4/
ASAV=A
IND=)
ANS=0.
IF ( IOP3.NE.1 ) GO TO 1105
ALPHA=ALPHA1
XJ=XJ1
ACC=ACC1
JX=JX1
GO TO 1111
1105 CONTINUE
IF ( IOP3.NE.1 ) GO TO 1107
ALPHA=ALPHA3
ACC=ACC3
XJ=XJ3
UX=UX3
GO TO 1111
1107 CONTINUE
ALPHA=ALPHA5
ACC=ACC5
XJ=XJ5
UX=JX5
1111 CONTINUE
IF ( A.LE.0.0 .OR. X.LT.0.0 ) GO TO 1131
IF ( X.GT.0.0 ) GO TO 1151
1121 CONTINUE
GO TO 1171
1131 ANS=2.
RETJRN
1151 CONTINUE
IF ( A.LT.15. ) GO TO 1331
RTA=SQRT(A)
IF ( ACO.LT.ACC1 ) GO TO 1155
IF ( A.GE.X ) GO TO 1151
FP=1.-1./(9.*A)*ALPHA/(3.*RTA)
FP=-FP*FP*FP*A+X
IF ( FP.GE.0.0 ) GO TO 1191
1155 CONTINUE
IF ( A.LT.A9A2 ) GO TO 1331
IF ( (.75*A).GT.X.OR.(1.25*A).LT.X ) GO TO 1331
GO TO 5011
1161 CONTINUE
CONTINUE
FM=1.-1./(9.*A)-ALPHA/(3.*RTA)
FM=-FM*FM*FM*A+X
IF ( FM.LE.0. ) GO TO 1121
GO TO 1155
1171 CONTINUE
ANS=0.
QANS=1.
RETJRN

```

Program Listing -- GAMINV

```

1191 CONTINUE
1311 CONTINUE
      ANS=1.
      QANS=3.
      RETURN
1331 CONTINUE
      IF ( A.LE.X ) GO TO 1441
1341 CONTINUE
      IF ( A.GE.30. ) GO TO 1343
      ALGX=ALOG(X)
      T1=-X+A*ALGX
      CALL GAMCO3 ( A,H,ACC,GANS )
      R=EXP(T1)/GANS
      GO TO 1349
1343 CONTINUE
      AISQ=1./(A*A)
      T1=A-X+A*ALOG(X/A)+(((AISQ-1.3333 37333 33333)*AISQ+4.656 65666
1 666667)*AISQ-140.)/(1680.*A)
      R=RTA*EXP(T1)*.39894 22804 01433
1349 CONTINUE
      IF ( A.GT.X ) GO TO 1351
1350 CONTINUE
      IF ( A.LT.1. ) GO TO 1459
      IF ( A.GE.X ) GO TO 3311
      GO TO 3315
1351 CONTINUE
      IF ( R.LE.(.2*A*(1.-X/(A+1.))*ACO) ) GO TO 1171
      GO TO 1350
1441 CONTINUE
      IF ( X.GE.X0 ) GO TO 1341
      TMOA=2.*A
      J=INT(TMOA)
      T1=ABS(FLOAT(J)-TMOA)
      IF ( T1.GT.0. ) GO TO 1341
      I=J/2
      AF=A-#LOAT(I)
      IF ( AF.GT.0. ) GO TO 6011
      GO TO 6071
1459 CONTINUE
      IF ( X.LT.1.5 ) GO TO 1461
      T1=(2.+X-A)/(1.+X)
      IF ( R.LE.(ACO*X*T1*.2) ) GO TO 1311
      IF ( R.GT.(.101*X*T1) ) GO TO 3311
      GO TO 7011
1461 CONTINUE
      INJ=1
      GO TO 3011

C
C      THIS IS PART F
C
2011 CONTINUE
      ACC7=.5*ACC
      T7=A*A/ALGX
      CEE=2.
      T=T7/CEE

```

Program Listing - GAMINV

```

2031  SUN=T
      CONTINUE
      CEE=CEE+1.
      T=(T*T7)/CEE
      SUM=SJM+T
      IF ( ABS(T).GT.ACC7 ) GO TO 2031
      T2=T7*(1.+SUM)
      TK=-X
      CEE=1.
      AJK=TK/(A+CEE)
      SJM=AJK
2071  CONTINUE
      CEE=CEE+1.
      TK=-(X*TK)/CEE
      AJK=TK/(A+CEE)
      SUM=SUM+AJK
      IF ( ABS(AJK).GE.-ACC*SUM) GO TO 2071
      T3=-A*SUM
      T1=H
      T4=T1+T2
      T5=T1*T2
      QANS=T3-T4+T3*(T4+T5)-T5
      ANS=1.-QANS
      RETURN
3005  CONTINUE
      IF ( X.LE.CEP ) GO TO 3011
      IF ( X.LT.X0 ) GO TO 7011
      IF ( A.LT.2. ) GO TO 3006
      IF ( (R*(X+1.)).LE.(ACC*X*(2.+X-A)*.2)) GO TO 1311
      GO TO 9011
3006  CONTINUE
      IF ( R.LE.(.2*ACC*(X+1.-A))) GO TO 1311
      GO TO 9011

C
C
C      THIS IS PART A
C
3011  CONTINUE
      MAVACC=ACC*.5
      ROVA=R/A
      SNP1=1.
      SUM=SNP1
      CEE=A
3031  CONTINUE
      CEE=CEE+1.
      T1=X/CEE
      SNP1=SNP1*T1
      SUM=SUM+SNP1
      IF ( T1.GT..66666 66666 66667 ) GO TO 3031
3041  CONTINUE
      IF ( SNP1.LE.MAVACC ) GO TO 3051
      CEE=CEE+1.
      SNP1=(SNP1*X)/CEE
      SUM=SUM+SNP1
      GO TO 3041

```

Program Listing - GAMINV

```

3051 CONTINUE
ANS=ROVA*SUM
QANS=1.-ANS
IF ( ;NO.EQ.1.AND.ANS.GT.0.9 ) GO TO 2011
RETURN

C
C      THIS IS PART E1
C
5011 CONTINUE
AISQ=1./(A*A)
T1=A-X+A*ALOG(X/A)*(((AISQ-1.3333 33333 333333)*AISQ+4.666 66666
1 666667)*AISQ-140.)/(1680.*A)
R=RTA*EXP(T1)*.39894 22804 01433
ASAV=A
A=A-1.
ALPHY=3.*SQRT(A+2./3.)
ALPINV=1./ALPHY
A2THRD=A+.66666 66666 66667
DELTA=(X-A)-.66666 66666 66667
SZ=DELTA/A2THRD
Z=EXP(.33333 33333 33333*ALOG(X/A2THRD))
S0=(ALPHY*SZ)/((Z+1.)*Z+1.)
XSAV=X
X=(S0*S0)/2.
RTX=ABS(S0)/RT2
T5=EXP(-X)
IF ( X.GT.0.25 ) GO TO 5361
T1=((P3*X+P2)*X+P1)*X+P0
T3=((Q3*X+Q2)*X+Q1)*X+Q0
DEL=RTX*(T1/T3)
CERF=1.-DEL
GO TO 5381
5361 CONTINUE
IF ( X.GT.16.) GO TO 5371
T1=C1+RTX*(C1+RTX*(C2+RTX*(C3+RTX*(C4+RTX*(C5+RTX*(C6+C7*RTX))))))
1 )
T3=D0+RTX*(D1+RTX*(D2+RTX*(D3+RTX*(D4+RTX*(D5+RTX*(D6+RTX*D7))))))
1 )
CERF=T1/T3
DEL=1.-CERF
GO TO 5381
5371 CONTINUE
T=L/X
T1=ALPH0+T*(ALPH1+T*(ALPH2+T*(ALPH3+T*ALPH4)))
T3=BET1+T*(BET2+T*(BET3+T*BET4))
CERF=(1./RTX)*(1./RT PI+T1/(T3*X))
DEL=1.-CERF
5381 CONTINUE
ZAJ=+1.
IF ( X.LE.0.25 ) ZB0=(.5*CERF*RT2PI)/T5
IF ( X.GT.0.25 ) ZB0=.5*CERF*RT2PI
IF ( S0.GE.0. ) GO TO 5389
ZAJ=-1.
5389 CONTINUE
X=XSAV

```


Program Listing - GAMINV

```

Z3(1)=Z30
ZA(1)=ZA0
SJS2=SJ*SQ
T7=-1./ (ABS(SJ))
TOL=ACC*Z30
DO 5391 L=2,5
K=2*(L-1)
T7=T7*SQSQ
Z3(L)=-T7
1   +(FLOAT(K)-1.)*Z3(L-1)
5391  ZA(L)=-T7   *SQ+FLOAT(K)*ZA(L-1)
CONTINUE
V3(1)=Z3(1)
V3(2)=-.63333 33333 33333E-1*Z3(3)
VA(1)=.66666 66666 66666E-1*ZA(3)
S3(1)=V3(1)
A_PHSQ=ALFINV*ALPINV
A_PHC3=ALPHSQ*ALPINV
S3(2)=V3(2)*ALPHSQ
SA(1)=VA(1)*ALPHC3
T15=S3(1)+S3(2)
T17=SA(1)
V3(3)=- (Z3(4)-.0625*Z3(5))* .55555 55555 55556E-1
VA(2)=.47619 04761 04761E-1*ZA(4)-.55555 55555 55556E-2*ZA(5)
T23=A_PHSQ
I5=3
MF=J
5395  CONTINUE
I7=I5-1
T23=T23*ALPHSQ
S3(I5)=V3(I5)*T23
S4(I7)=VA(I7)*T23*ALPINV
T15=T15+S3(I5)
T17=T17+SA(I7)
IF ( ABS(S3(I5)).LT.TOL.AND.ABS(SA(I7)).LT.TOL ) GO TO 5431
I3=2*I5
I5=I5+1
T7=T7*SQSQ
T25=6.*FLOAT(I5)-7.
Z3(I3)=-T7+T25*Z3(I3-1)
Z4(I3)=-T7*SQ+(T25+1.)*Z3(I3-1)
T7=T7*SQSQ
Z3(I3+1)=-T7+(T25+2.)*Z3(I3)
Z4(I3+1)=-T7*SQ+(T25+3.)*Z3(I3)
MF=MF+1
GO TO ( 5397,5399,5401,5403,5405,5407,5409,5411,5413,5415,5431),MF
1
5397  CONTINUE
V3(4)=- (Z3(5)-.16444 44444 44444*Z3(6)+.23148 14814 814*1E-2*Z3(7)
1   )*.41666 66666 66667E-1
VA(3)=(ZA(5)-.20714 28571 42857*ZA(6)+.00625*ZA(7))* .37037 03703
1   7)370E-1
GO TO 5395
5399  CONTINUE
V3(5)=- (Z3(6)-.24370 10582 01058*Z3(7)+.11342 59259 25926E-1*Z3(8)

```

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Program Listing - GAMINV

```
1      )-.60281 63580 24691E-4*ZB(9))* .33333 33333 33333E-1
VA(4)=.33303 03030 30303E-1*ZA(6)-.A5097 00176 36684E-2*ZA(7)
1      +.52336 86.67 01940E-3*ZA(6)-.64300 41152 26337E-5*ZA(9)
GO TO 5395
5401 CONTINUE
V3(6)=-.129(7)-.31303 85487 52834*ZB(8)+.23806 21693 12109E-1*Z3(9)
1      )-.47.67 90123 45679E-3*ZB(11)+.12050 32716 04938E-5*Z3(11))*
2      .27777 77777 77777E-1
VA(5)=.25641 12564 10256E-1*ZA(7)-.37892 14900 32601E-2*ZA(3)+
1      .70924 16225 74356E-3*ZA(9)-.21568 19017 93063E-4*ZA(10)
2      +Z4(11)*.13395 91906 72154E-6
GO TO 5395
5403 CONTINUE
VA(5)=+.22222 22222 22222E-1*ZA(8)-.88026 17135 95047E-2*ZA(9)+
1      .10129 13208 68740E-2*ZA(10)-.42538 29446 73068E-4*ZA(11)+
2      .62437 74387 13028E-6*ZA(12)-.22326 53177 86923E-6*ZA(13)
VB(7)=-.23809 52380 95238E-1*ZB(8)+.88185 92672 75934E-2*ZB(9)-
1      .90642 29253 23273E-3*ZB(10)+.31511 18214 77562E-4*ZB(11)-
2      .32596 73639 68907E-6*Z3(12)+.40513 60737 22756E-9*Z9(13)
GO TO 5395
5405 CONTINUE
VA(7)=+.19607 84313 72549E-1*ZA(9)-.86836 01357 26702E-2*ZA(10)+
1      .11301 47027 03357E-2*ZA(11)-.66655 77635 71536E-4*ZA(12)+
2      .15617 53570 88423E-5*ZA(13)-.13739 92297 55917E-7*ZA(14)+
3      .31109 07191 48504E-10*ZA(15)
VB(8)=-.20833 33333 33333E-1*Z3(9)+.87544 99954 21366E-2*ZB(10)-
2      .11392 44092 74237E-2*ZB(11)+.54338 41632 21759E-4*ZB(12)-
3      .10360 16990 45849E-5*ZB(13)+.63258 50670 62948E-3*ZB(14)-
3      .55373 34270 50100E-11*ZB(15)
GO TO 5395
5407 CONTINUE
VA(8)=+.17543 85904 91228E-1*ZA(10)-.84985 14229 13981E-2*ZA(11)+
1      .13448 60337 51072E-2*ZA(12)-.92061 86407 70127E-4*ZA(13)+
2      .29398 23607 35374E-5*ZA(14)-.42707 63569 50073E-7*ZA(15)+
3      .24541 46544 68959E-9*ZA(16)-.36915 56180 33933E-12*ZA(17)
VB(9)=-.18518 51851 65185E-1*Z3(10)+.65966 42554 97589E-2*Z3(11)-
1      .12744 20546 38934E-2*Z3(12)+.79234 62192 68942E-4*ZB(13)-
2      .21983 32483 95004E-5*Z3(14)+.25640 60419 02548E-7*ZB(15)-
3      .10320 26659 58016 E-9*Z3(16)+.57600 56531 74020E-13*Z3(17)
GO TO 5395
5409 CONTINUE
VA(9)=+.15373 01007 30159E-1*ZA(11)-.82821 56153 67318E-2*ZA(12)
1      +.14652 06930 61439E-2*ZA(13)-.11757 92089 58914E-3*ZA(14)+
2      .47065 76997 79354E-5*ZA(15)-.95201 29482 98324E-7*ZA(16)+
3      .92392 73029 09851E-3*ZA(17)-.36402 25970 59366E-11*ZA(18)+
4      .38453 71021 18680E-14*ZA(19)
V3(10)=-.16666 00060 66667E-1*ZB(11)+.83928 01741 73222E-2*ZB(12)
1      -.14082 22293 54083E-2*ZB(13)+.10485 97493 66735E-3*ZB(14)-
2      .37786 94453 83984E-5*ZB(15)+.65709 46457 57853E-7*ZB(16)-
3      .06433 50733 06120E-9*ZB(17)+.13412 65412 18996E-11*ZB(18)-
4      .53407 93084 98167E-15*ZB(19)
GO TO 5395
5411 CONTINUE
VA(10)=+.14492 75302 31884E-1*ZA(12)-.80534 46095 24176E-2*ZA(13)
2      +.15625 36761 62327E-2*ZA(14)-.14249 82760 43991E-3*ZA(15)+
```

Program Listing -- GAMINV

```

3 .57347 44263 92697E-5*ZA(16)-.17514 13319 57715E-6*ZA(17)+
4 .24007 91370 41612E-5*ZA(18)-.16288 16309 64713E-10*ZA(19)+
5 .46225 32193 27600E-13*ZA(20)-.35605 28723 32111E-16*ZA(21)
V3(11)=-.15151 51515 15152E-1*ZB(12)+.81685 47795 41828E-2*ZB(13)
1 -.15164 52843 22835E-2*ZB(14)+.13014 45605 38248E-3*ZB(15)-
2 .57147 99417 62549E-5*ZB(16)+.13158 76549 27332E-6*ZB(17)-
3 .15383 56544 74373E-8*ZB(18)+.82135 07414 80055E-11*ZB(19)-
4 .15549 66311 87868E-13*ZB(20)+.44506 60904 15139E-17*ZB(21)
GO TO 5395
5413 CONTINUE
VA(11)=+.13333 33333 33333E-1*ZA(13)-.78228 73159 47945E-2*ZA(14)
1 +.15412 35305 54189E-2*ZA(15)-.16641 22539 53536E-3*ZA(16)+
2 .91369 09627 54997E-5*ZA(17)-.28427 17670 98726E-6*ZA(18)+
3 .53343 42786 29405E-8*ZA(19)-.49118 23691 34031E-10*ZA(20)+
4 .24317 07160 76481E-12*ZA(21)-.51251 26773 74051E-15*ZA(22)+
5 .29671 7269 43426E-13*ZA(23)
V3(12)=-.13888 88888 88889E-1*ZB(13)+.79379 48362 75189E-2*ZB(14)
1 -.16039 76493 89170E-2*ZB(15)+.15459 78095 11729E-3*ZB(16)-
2 .79380 81011 28000E-5*ZB(17)+.22651 75615 82738E-6*ZB(18)-
3 .35325 6641 8641E-8*ZB(19)+.29351 25130 22109E-10*ZB(20)-
4 .11351 52915 07799E-12*ZB(21)+.15785 01067 33903E-15*ZB(22)-
6 .33717 12606 17530E-19*ZB(23)
GO TO 5395
5415 CONTINUE
VA(12)=+.12345 67901 23457E-1*ZA(14) -.75962 63771 72480E-2*ZA(15)
1 5)+.17048 20355 90103E-2*ZA(16)-.18910 65799 70833E-3*ZA(17)+
2 .11572 03320 56449E-5*ZA(18)-.42273 44701 27948E-6*ZA(19)+
2 .91376 18615 14362E-8*ZA(20)-.11653 40193 25387E-9*ZA(21)+
3 .94315 10565 35040E-12*ZA(22)-.31318 52910 85580E-14*ZA(23)+
4 .50384 30725 14408E-17*ZA(24)-.22478 06537 45020E-20*ZA(25)
V3(13)=-.12820 51282 05120E-1*ZB(14)+.77088 28747 69910E-2*ZB(15)
1 -.16747 26889 27663E-2*ZB(16)+.17731 99594 95527E-3*ZB(17)-
2 .11383 04179 05402E-4*ZB(18)+.34937 60792 28262E-6*ZB(19)-
3 .58844 70270 71384E-8*ZB(20)+.77434 50300 60715E-10*ZB(21)-
4 .47532 73760 28715E-12*ZB(22)+.13508 28991 58372E-14*ZB(23)-
5 .14341 01846 89323E-17*ZB(24)+.23414 67226 51062E-21*ZB(25)
GO TO 5395
5431 CONTINUE
T=1./A
CST=((((CST5*T-CST4)*T+CST3)*T+CST2)*T-.11959 87654 32199E-1)*T
1 +.27777 77777 77778 E-1)*T+1.
PAP1X=(CST*(T15+T17)*T5)/RT2PI
A=ASAV
IF ( S. .LT. ) GO TO 5441
QANS=PAP1X
ANS=1.-QANS
GO TO 5451
5441 CONTINUE
ANS=PAP1X
QANS=1.-ANS
5451 CONTINUE
RETURN

```

C
C
C

THIS IS PART 01

Program Listing - GAMINV

```
6011 CONTINUE
      N=0
      RTX=SQRT(X)
      T5=EXP(-X)
      RN=T5/(RTX*GAMPT5)
```

C
C
C

THIS IS PART B1 SUPPLEMENT

```
IF ( X.GT.16.) GO TO 6J31
      T1=CU+RTX*(C1+RTX*(C2+RTX*(C3+RTX*(C4+RTX*(C5+RTX*(C6+C7*RTX))))))
      T3=DU+RTX*(D1+RTX*(D2+RTX*(D3+RTX*(D4+RTX*(D5+RTX*(D6+RTX*DF))))))
      DEL=(T5*T1)/T3
      GO TO 6J91
```

```
6031 CONTINUE
      T=1./X
      T1=ALPH0+T*(ALPH1+T*(ALPH2+T*(ALPH3+T*ALPH4)))
      T3=BET0+T*(BET1+T*(BET2+T*(BET3+T*BET4)))
      DEL=( T5 /RTX)*(1./RTPI +T1/(T3*X))
      GO TO 6091
```

```
6071 CONTINUE
      N=1
      RN=EXP(-X)
      DEL=RN
```

```
6091 CONTINUE
      PNCX=DEL
      CEE=AF+FLCAT(N)-1.
```

```
6101 CONTINUE
      IF ( N.EQ.I ) GO TO 6111
      N=N+1
      CEE=CEE+1.
      RN=(X*RN)/CEE
      PNCX=PNCX+RN
      GO TO 6101
```

```
6111 CONTINUE
      R=X*RN
      QANS=PNCX
      ANS=1.-QANS
      RETURN
```

C
C
C

THIS IS PART C

```
7011 CONTINUE
      A2NM1=1.
      A2N=1.
      B2NM1=X
      B2N=X+1.-A
      AN=1.
```

```
7031 CONTINUE
      A2NM1=X*A2N+AN*A2NM1
      B2NM1=X*B2N+AN*B2NM1
      ANB=A2NM1/B2NM1
      AN=AN+1.
      SA2N=AN-A
```

Program Listing - GAMINV

```
A2N=A2NM1+SA2N*A2N
B2N=B2NM1+SA2N*B2N
ANJ=A2N/B2N
IF ( ABS(ANJ-AMJ).GE.(ACC*ANG) ) GO TO 7031
QANS=R*ANJ
ANS=1.-QANS
RETURN
```

```
C
C      THIS IS PART D
C
```

```
9011 CONTINUE
    SNP1=1.
    SUM=SNP1
    CEE=A
9031 CONTINUE
    CEE=CEE-1.
    SNP1=(SNP1*CEE)/X
    SUM=SJM+SNP1
    IF ( ABS(SNP1).GE.ACC ) GO TO 9031
    QANS=(R*SUM)/X
    ANS=1.-QANS
    RETURN
END
```

Program Listing - GAMINV

```

SUBROUTINE GAMCO3 ( A,M,      AC ,T1 )
DIMENSION C(30)
DATA ( C(I),I=3,18 ) /
1  +.57721 56649 01533 E+0 ,
2  -.65587 80715 2J254 E+0 ,
3  -.42002 63503 40952 E-1 ,
4  +.16653 86113 02291 E+0 ,
5  -.42197 73455 55443 E-1 ,
6  -.95219 71527 87697 E-2 ,
7  +.72189 43246 66310 E-2 ,
8  -.11651 67591 05907 E-2,
9  -.21524 16741 14951E-3,
1  +.12805 02023 08116 E-3,
2  -.20134 85470 67802 E-4 ,
3  -.12504 93492 14267 E-5 ,
4  +.11330 27231 90170 E-5 ,
5  -.20563 38416 97761 E-6 ,
6  +.50160 95104 48142 E-8 ,
7  +.50020 07644 46922 E-8 /
ACC=.5*AC
I=INT(A)
A=A-FLOAT(I)
IF ( AF.EQ.0 . ) GO TO 3031
CEE=AF-1.
IF ( AF.LT.0.5 ) CEE=AF
PHI=CEE
<=3
ANK=C(K)*CEE
SUM=ANK
3011 CONTINUE
CEE=CEE*PHI
K=K+1
ANK=C(K)*CEE
SUM=SJM+ANK
IF ( ABS(ANK).LT.(ACC*ABS(SUM)) ) GO TO 3031
IF ( K.EQ.18 ) GO TO 3031
GO TO 3011
3031 CONTINUE
H=SJM
IF ( AF.GE.0.5 ) H=(1.-A+SUM)/A
T1=1.+SUM
IF ( AF.LT.0.5 ) T1=AF*T1
T1=1./T1
IF ( I.EQ.0 ) RETURN
AJ=AF-1.
J=)
3051 CONTINUE
J=J+1
AJ=AJ+1.
T1=AJ*T1
IF ( J.LT.I ) GO TO 3051
3071 CONTINUE
GO TO 3151
3091 CONTINUE
J=)

```

Program Listing - GAMINV

```
T1=1.  
IF ( I.EQ.1 ) RETURN  
I=I-1  
3131 CONTINUE  
J=J+1  
T1=FLOAT(J)*T1  
IF ( J.LT.I ) GO TO 3131  
3151 CONTINUE  
RETURN  
END
```

Program Listing - GAMINV

```
SJROUTINE EVA ( A,X,R )
DATA ACC/5.E-13/
IF ( A.GE.30. ) GO TO 13+3
T1=-X+A*ALOG(X)
CALL GAMCOJ ( A,H,ACC,GANS )
R=EXP(T1)/GANS
RETURN
13+3 CONTINUE
RTA=SQRT(A)
AIS2=1./(A*A)
T1=A-X+A*ALOG(X/A)+(((AISQ-1.3333 33333 33333)*AISQ+4.666 66666
1 666667)*AISQ-140.)/(1680.*A)
R=RTA*EXP(T1)*.39894 22804 01433
RETURN
END
```


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