ANALYSTS' MANUAL
FOR THE
ITEM ACQUISITION/PRODUCTION
TRADE-OFF MODEL
COLD BASE VERSION
DECEMBER 1977

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JOINT CONVENTIONAL AMMUNITION PROGRAM COORDINATING GROUP
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8. **ABSTRACT**
   - The JCAP Item Acquisition/Production Trade-Off Model is a computerized decision model written in the FORTRAN, MPSX, and COBOL computer languages. The model is designed to develop an optimum cost-readiness relationship for an end item considering all available trade-off options that might meet requirements specified by logistics guidance. The model uses integer programming to identify specific optimum cost-readiness points either by maximizing readiness for a given cost or by minimizing cost for a given readiness.
This volume contains:

1. General background information to assist in understanding the environment for which the model is intended;
2. A mathematical description of the model;
3. A description of how the model is exercised; and
4. An appendix with computer source listings.
FOREWORD

In the Department of Defense environment, there is a need for the capability of evaluating the cost effectiveness of inventory acquisition and production trade-offs in the procurement process. This cost effectiveness is based on the optimum procurement plan for achieving a specified readiness. This plan is achieved by the utilization of component stockpiling and industrial preparedness measures (IPM's) and modernization investments.

To determine these optimum plans, based on joint specification by the Military Services, the Item Acquisition/Production Trade-Off Model was designed under the auspices of the Joint Conventional Ammunition Program Coordinating Group. This model has been successfully demonstrated by the Military Services.

This Analysts' Manual and a companion document, The Users' Manual, comprise an export package which will permit the Military Services to install and use this Item Acquisition/Production Trade-Off Model.

The Analysts' Manual consists of an explanation of the Item Acquisition/Production Trade-Off Model concept, along with appropriate uses of the model. It also describes in detail the input variables and how they are entered and arranged. Included also are descriptions of the model output and sample formats with descriptions of data input and output.

Configuration management of the model is retained by the Joint Conventional Ammunition Program Decision Models Directorate. Proposals for modification of the model and inquiries with respect to the model application and operation should be addressed to the Director, Joint Conventional Ammunition Program Decision Models Directorate, Rock Island Arsenal, IL 61299. Telephone inquiries should be addressed to the Chief, Item Acquisition and Materiel Planning Division, Decision Models Directorate, AUTOVON 793-5980.
ANALYSTS' MANUAL
FOR THE
ITEM ACQUISITION/PRODUCTION TRADE-OFF MODEL

This Analysts' Manual and a separately published Users' Manual provide detailed instructions and information for the Item Acquisition/Production Trade-Off (IA/PT) Model. The IA/PT Model was designed, developed, and demonstrated by the Joint Conventional Ammunition Program Decision Models Directorate in response to requirements established by the Military Services. The model has been accepted for their use as described herein.

Although the Item Acquisition/Production Trade-Off Model was designed to assist managers in the ammunition production base area, it is applicable to any commodity when the effects of inventory acquisition and production trade-off must be evaluated by decision makers.

EDWARD J. JORCA
Executive Director
ABSTRACT

The JCAP Item Acquisition/Production Trade-Off Model is a computerized decision model written in the FORTRAN, MPSX, and COBOL computer languages. The model is designed to develop an optimum cost-readiness relationship for an end item considering all available trade-off options that might meet requirements specified by logistics guidance. The model uses integer programming to identify specific optimum cost-readiness points either by maximizing readiness for a given cost or by minimizing cost for a given readiness.

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(4) An appendix with computer source listings.
ACKNOWLEDGEMENTS

The contributions of the following individuals to the development, modification, application, and documentation efforts on this model are gratefully acknowledged.

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In May 1972 the Joint Logistics Commanders (JLC) established the Joint Conventional Ammunition Production Coordinating Group (JCAP/CG) and gave it the authority to coordinate and take action on all conventional ammunition production base activities and programs delegated by the respective commanders. The JCAP/CG basic charter was expanded in October 1974 to include conventional ammunition logistics programs and activities; and the name of JCAP/CG was changed to Joint Conventional Ammunition Program Coordinating Group. Under the sponsorship of the JCAP/CG, the Joint Conventional Ammunition Program Operating Group (JCAP/OG) has the responsibility for administering the Coordinated Management System for the DoD Conventional Ammunition Logistics Activities and Programs.

As directed by the JCAP/OG, the JCAP Decision Models Directorate (JCAP-DM) designs, develops, tests and provides guidance for implementation of all decision models, both economic and non-economic, required in the joint management of conventional ammunition logistics activities and programs.

The Joint Panel Report which led to the formation of JCAP states the motivation for development of the Item Acquisition/Production Trade-Off (IA/PT) Model: "An economic model(s) is needed that enables the determination of the most cost effective manner to program the ammunition production base so as to minimize the amount of inventory required while maximizing the responsiveness of the production base to meet wartime needs."

There are two ways of reducing inventory or inventory costs through use of the IA/PT model. Speed of production response to mobilization demands may be improved; or ammunition components may be stored instead of storing end items only. The IA/PT Model compares costs of increasing component and end item inventories with production response alternatives and identifies the least-cost alternative for improving readiness for management use.

The following table lists some of the end items studied during model development. The potential savings are found by comparing the IA/PT Model solution to buying end items only.
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*Total does not include first CBU 58B study

This IA/PT Model Analysts' Manual contains basic model concepts, a mathematical description of the model, a program listing, and information needed to make computer runs. A companion IA/PT Model User's Manual describes input data and input data formats used in the model. For further information about the IA/PT Model and its application, the point of contact is Mr. George Martin (JCAP-DM) AUTOVON 793-5980, Commercial (309) 794-5980.
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CHAPTER 1

INTRODUCTION

1-1. GENERAL

This Analysts' Manual is one of two manuals for the JCAP Item Acquisition/Production Trade-Off Model (IA/PT). It contains sufficient information to permit the reader to operate the model. The companion Users' Manual describes how to prepare the input and interpret the output.

1-2. BACKGROUND

In planning to meet mobilization requirements, it is necessary to consider the mix of inventory and production response. The IA/PT model was developed to evaluate the trade-offs involved. The following discussion provides a basis for understanding how the model functions.

a. Post D-day Concept

(1) The post D-day (D-day is the day hostilities are declared) concept is a planning method used for the evaluation of the capability of meeting combat requirements from inventory and production. It provides a tool for ammunition planning that is independent of the duration of the conflict, but which assures the defense planner a reasonable degree of readiness to meet wartime consumption. The classic inventory/production response trade-off is based on a known demand for the product under consideration. Knowing this demand, the planner establishes an appropriate stock level (inventory policy) and production response to meet the demand. Demand for an ammunition item is supported from inventory procured before D-day and from production after D-day. Combat ammunition uses requirements rates which eventually level off at a constant value. Since the production rate for an item will not be programmed to decrease during a mobilization period, it is only necessary that the IA/PT address satisfaction of the requirements up to the time that the production rate meets or exceeds the requirements (this time is called "P-day") or some earlier specified time.
Figure 1 illustrates projected ammunition consumption and production for an item. The vertical axis represents a rate (rounds/month) and the horizontal axis represents time (months). Therefore, an area on the chart represents a quantity of ammunition. The area under the production curve for a specified time period is the quantity of ammunition produced (the "production offset" for the period). The difference between what ought to be available for conflict (cumulative requirements) and what can be produced during conflict (production offset) must be stockpiled if requirements are to be met.

b. Inventory/Production Response Trade-Off

Production rate decisions are sensitive to maintenance and layaway policies, modernization programs, item and component inventory, and production base activity. When the goal is to minimize cost, the planner should select the combination of item and component inventory and production response expenditures that incurs the least cost and still meets the desired level of readiness. If the funding level changes for these expenditures, the mobilization production response rate changes and the inventory required to provide a specified readiness changes.
(2) Figure 2 portrays major events and activities involved in the trade-off process. The end of the planning period and the beginning of the Five Year Defense Program (FYDP) is designated as T-day. Assets-on-hand (inventory) as of T-day are considered to have been acquired with sunk funds (funds that have been committed) and are not available for trade-off and so are not a part of the current decision process. (Assets on hand contribute to current readiness but can't be converted to funds to improve production response). The production curve (solid line) can be moved as a result of decisions made by the planner.

(3) To exactly meet requirements, initial assets plus production must equal consumption plus quantity in transit (not shown in figures). Because mobilization production cannot start immediately on D-day, a large part of the combat requirements must be met by inventory. This is illustrated in Figure 2. The inventory accumulated in peacetime must be adequate to support consumption until mobilization production can increase to support consumption needs.
be included. One of the trade-offs to be considered is improving mobilization production response so that inventory may be decreased. A second trade-off involves the comparison of production response for components of the end item versus the end item production response. When the end item production can increase more rapidly than production of one or more of its components, component storage should be considered.

c. Costing Policies

(1) The DOD logistics guidance states that costs should be minimized during the FYDP. There are two costing policies which have a direct impact on the management of the ammunition production base. They are peacetime costing and total costing.

(a) During peacetime periods, funds for inventory acquisition and facility maintenance, retention, modernization, and expansion are severely limited. Thus, the available money must be judiciously allocated between inventory acquisition and production response to achieve the maximum readiness. During the post-D-day period, funds are expected to be much more readily available and can be used to accelerate production of ammunition to sustain combat requirements. Therefore, this is the rationale for considering only peacetime costs.

(b) Total costing involves determining the total discounted cost of inventory acquisition and facilities modernization and expansion for a specific time frame.

(2) Costing policies are significant in the management of the ammunition production base, but they have little impact on the modeling techniques used. The IA/PT model is normally operated with peacetime costing but can be modified for use with total costing.

d. Period Considered in IA/PT Analysis

Any planning period may be used with the IA/PT model. The period following D-day for which requirements and production are included in the analysis depends on the scenario desired for the study. Since the post-mobilization period is variable, the model can be used to perform short to long term planning. For the long term situation, a 24-month period is normally used. There is no need to consider post-mobilization periods extending past the point that production exceeds requirements. The use of the FYDP period in describing data inputs reflects the intended use of the IA/PT model in FYDP planning, but the user should select the period appropriate to the planning situation.
e. Model Application

(1) The IA/PT model makes trade-offs for a single end item at a time; it selects a plan specifying a combination of plant response, end item inventory, industrial preparedness measures (IPM's), and component inventory. The model provides either the least cost plan to meet a specified level of item readiness, or a maximum readiness plan for a specified budget.

(2) Ammunition readiness is a measure of the availability of an item relative to the requirements for that item. The IA/PT model uses a readiness measure, the readiness ratio (RR), to indicate the capability to support requirements following mobilization. The readiness ratio for an item defines a planned asset allocation until no assets remain (N-Day); subsequent requirements are supported only by production. An equation for readiness ratio may be written as follows, for each item:

\[
RR = \frac{\sum_{i=1}^{N} \left( Assets_i + (Proc + Prod-Losses) + \sum_{d=1}^{D} Production\right)}{\sum_{d=1}^{D} \text{Requirements}}
\]

Where
- \( Assets_i \): Represents those assets for which funds will have been committed by T-day
- \( \sum_{i=1}^{N} (Proc + Prod) \): Total peacetime procurement and production unfunded at T-day
- \( \sum_{i=1}^{N} Losses \): Total of training and other peacetime ammunition uses
- \( \sum_{d=1}^{D} Production \): The production offset through N-day
- \( \sum_{d=1}^{D} \text{Requirements} \): Represents cumulative requirements through N-day (including materiel in transit)
(3) The use of the RR defined above is intended to apply only in the 0.0 to 1.0 interval. A current RR is calculated to project readiness obtained by using T-day assets and projected mobilization production response figures in the above equation. At the two extremes: if the "basic load", "ships stores" or similar stockage cannot be met, then no assets will be available for trade-off (N-day is the same as D-day) and current RR = 0.0; if assets equal or exceed cumulative requirements to P-day then the current RR is 1.0.

(4) The period over which requirements are considered is variable. This will be determined by the scenario or specific study constraints but in any case, extending time past P-day will have no effect on results from the model.

FIGURE 3. DETERMINATION OF N-DAY
(5) Figure 3 shows how N-day is normally determined. Assets are allocated so that the sum of assets plus production is a constant fraction of requirements and there are no more assets when the production rate equals this allocation rate. (Cross-hatching is used to show that assets fill the area above the production response.) N-day is the day inventory is exhausted, when allocation is made by the above rule. If requirements are met without using up all of the assets, N-day and P-day are the same and RR = 1.0. For RR less than 1.0, the production rate continues to increase after N-day and from N-day to P-day the ratio of the amount of ammunition available to the amount required is larger than the readiness ratio. After N-day, requirements are satisfied only from post D-day production. If the period selected for the analysis is too short to permit the production rate to equal the allocation rate at N-day, assets are to be used up in the period and N-day is the end of the period.
(6) The selection of component buy or end item buy depends on the relationship of the component production to the end item production (Load, Assembly, and Pack or "LAP") response. If, as shown in Figure 4, a component production rate occurs later than the end item LAP rate, requirements represented by the area between the two curves can be satisfied by stockpiling components. These stockpiled components would then be available to supply maximum LAP capabilities. For one end item, more than one component may need to be stockpiled. Lower costs associated with component storage often make component stockpiling cheaper than end item stockpiling. The model will select the lowest cost alternative.

![Figure 5. 1PM Trade-Off](image-url)
(7) An Industrial Preparedness Measure (IPM) is any action taken prior to D-day to improve post D-day response. If the time improvement resulting from the implementation of an IPM is as shown in Figure 5, then the area between the two response curves is equivalent to a specific amount of inventory. The IA/PT model compares the costs of the IPMs to the cost of this inventory and selects the cheapest.

(8) Depending on the objective of the user, the IA/PT model selects either the least-cost solution or the maximum readiness solution. In either case, the solution specifies the quantities of components and end items to be procured and the IPM's to be implemented.
CHAPTER II
MODEL

2-1. INTRODUCTION

The Item Acquisition/Production Trade-Off Model (IA/PT) is used for a single end item and its components. For any specific readiness ratio (RR), it yields the total minimum peacetime costs (or for any dollar budget, it maximizes the readiness ratio) by specifying quantities of end items and components to be stockpiled for use following mobilization, and selects IPM's for selected plants and production lines.

2-2. DEFINITION OF VARIABLES

a. Model decision variables used are:

\[ X_{p,g,i,j,k} \] amount of \( p \) production on line \( g \) with alternative \( i \) in month \( j \) for use in month \( k \)

\[ Y_{p,-1,k} \] amount of \( p \) to be produced in FYDP to be used in month \( k \)

\[ Y_{p,-2,k} \] amount of \( p \) available at beginning of planning period (T-day) to be used in month \( k \)

\[ I_{p,g,i} \] 1 if \( p \) is produced on line \( g \) using alternative \( i \), 0 otherwise

\[ R \] readiness ratio (RR)

b. The coefficients and constraints used by the model are:

\[ c_p \] average unit cost to produce product \( p \)

\[ E \] limit on available dollars

\[ r_{p,g,i} \] cost for alternative \( i \) on line \( g \) to produce \( p \)

\[ D_k \] requirement for end item in month \( k \)
\( \text{Q}_p \)  
limit on procurement of \( p \) 

\( \text{P} \)  
peacetime requirement (5 year) 

\( \text{T}_p \)  
inventory of \( p \) on hand at \( T \)-day 

\( b_{p,g,i,j} \)  
during production buildup, the fraction of the eventual maximum capacity to produce \( p \) on line \( g \) with alternative \( i \) in month \( j \) 

\( W_{p,g,i} \)  
monthly capacity to produce \( p \) on line \( g \) using alternative \( i \) 

\( U_p \)  
total storage capacity for \( p \) (including the quantity of \( p \) already stored) 

\( V \)  
pipeline requirement (materiel in transit) 

c. Subscripts and terminology used are: 

\( p \)  
product may be a component or an end item, \( p=1 \) represents the end item 

\( p^* \)  
end item or component that \( p \) supports 

\( g \)  
line 

\( i \)  
identifier for IPM alternatives 

\( j \)  
month of production 

\( k \)  
month of use 

\( s \)  
number of months from \( D \)-day to \( P \)-day 

\( T \)-day  
termination of current planning period (start of FYDP) 

\( R \)-day  
end of FYDP 

\( D \)-day  
declaration of war or mobilization 

\( N \)-day  
day assets are exhausted when allocated at constant readiness 

\( P \)-day  
day when production meets requirements
2-3. TECHNIQUES USED

The model utilized mixed integer programming optimization. Implementation of the current version is through the IBM MPSX software package.

2-4. COSTS CONSIDERED

Only two types of costs are considered. The first cost is for inventory acquisition of end items and components. The second cost is to implement each IPM. All costs are current year dollars.

2-5. OPTIMIZATION

The model can be run to obtain the lowest cost plan for some specified readiness "Mode 1" or obtain the highest readiness plan within some fixed budget "Mode 2".

a. For the Mode 1 case, the objective is to minimize total cost.

\[
\text{Minimize } \left( \sum_{p,k} c_{p,k}Y_{p,-1,k} + \sum_{p,g,i} \sum_{p,g,i} r_{p,g,i}i_{p,g,i} \right) \quad (1)
\]

This represents minimizing the sum of total component and end item production cost in the FYDP (with peacetime costing, production after D-day is "free") and the cost for those IPMs selected. Applicable constraints are discussed in paragraph 2-6.

b. For the Mode 2 case, the objective is to maximize readiness:

\[
\text{Maximize } R \quad (2)
\]

subject to a funding constraint in addition to the constraints discussed in paragraph 2-6. This funding constraint is a limitation on production and IPM set-up costs in the same form as in 2-5a.

\[
\sum_{p,k} c_{p,k}Y_{p,-1,k} + \sum_{p,g,i} \sum_{p,g,i} r_{p,g,i}i_{p,g,i} \leq E \quad (3)
\]

2-6. CONSTRAINTS

The following discusses constraints which apply for both of the optimizations above.

a. For each month, demand for the end item can be satisfied from three sources: inventory on hand, inventory to be purchased, and/or production before or during the month.
\[ Y_{1,-2,k} + Y_{1,-1,k} + \sum \sum \sum \chi_{1,g,i,j,k} \geq D_{k,R} \] (4)

For \( k = 1, 2, \ldots, s \)

b. For components, demand in a given month \((k_0)\) is the total
monthly production of the end item or component supported. There is
a minimum 30-day shipping period provided between component produc-
tion and utilization; component production must occur by month \( k_0 - 1 \).

\[ Y_{p,-2,k_0} + Y_{p,-1,k_0} + \sum \sum \sum \chi_{p,g,i,j,k_0 - 1} \geq \] (5)

\[ \sum \sum \sum \chi_{p^*,g,i,k_0,k} \forall p > 1, k_0 = 1, 2, \ldots, s \]

The left-hand-side (l.h.s.) has the same form as in the constraint
in paragraph 2-6a; the right-hand-side (r.h.s.) represents production
of the product support in month \( k_0 \) for use in \( k_0 \) or after.

c. After \( P \)-day, demand at the level described by the RR must
be satisfied by production.

\[ \sum \sum \chi_{1,g,i,s+1,s+1} \geq D_{s+1,R} \] (6)

\[ \sum \sum \chi_{p,g,i,r,r} \geq \sum \sum \chi_{p^*,g,i,s+1,s+1} \forall p > 1, r = s, s+1 \] (7)

For relation (6), the l.h.s. is total end item production on the month
following \( P \)-day; the r.h.s. shows the fraction of requirements which
must be supported. For relation (7), the l.h.s. is the component
production in the month in which \( P \)-day occurs and the following month;
the r.h.s. shows the production of components supported.

d. The allocation of inventory on hand, by month, must be
consistent with total \( T \)-day inventory.

\[ \sum_k Y_{p,-2,k} \leq T_p \forall p \] (8)

e. To limit procurement, the total FYDP period production is
constrained after the RR = 1.0 run (Constraint can be eliminated
if not applicable).
\[ \sum_{k} \gamma_{p,-1,k} \leq Q_{p} \quad \forall p \]  

(9)

f. For any month, production can be used in any later month for each line (the l.h.s.) and cannot exceed its buildup capability (the r.h.s.).

\[ \sum_{k\geq j} \kappa_{p,g,i,j} \leq b_{p,g,i,j} \gamma_{p,g,i,j} \quad \forall p,g,i,j \]  

(10)

g. Insure that no unnecessary lines are opened to satisfy post P-day requirements (constraints can be eliminated if not applicable and may be overridden by redefining the right hand side to a fixed value).

\[ \sum_{g,i} W_{p,g,i} \leq D_{p-1} + \text{Min}_{g,i} W_{p,g,i} \quad \forall p \]  

(11)

The l.h.s. shows the monthly capacity (not buildup) for a product; the r.h.s. is the demand at P+1 month plus the smallest capacity line producing the product.

h. At most, one alternative may be selected for each line, the IPMs are mutually exclusive, only one can be selected.

\[ \sum_{i} I_{p,g,i} \leq 1 \quad \forall p,g \]  

(12)

i. The total inventory for a product (the l.h.s.) is constrained by storage capacity (the r.h.s.) (constraint can be eliminated if not applicable).

\[ \sum_{k} \gamma_{p,-1,k} + \sum_{k} \gamma_{p,-2,k} \leq U_{p} \quad \forall p \]  

(13)

j. The materiel in transit (l.h.s.) is filled at the same level as the readiness ratio (r.h.s.).

\[ V_{1,-1,0} + V_{1,-2,0} \geq V \cdot R \]  

(14)
CHAPTER III
OPERATION

3-1. INTRODUCTION

This chapter describes operation of the Mathematical Programming System, Extended (MPSX) version of the model on the IBM 360/65. Computer input must be prepared as described in the IA/PT Users' Manual.

3-2. METHOD OF OPERATION

Four sets of Job Control Language (JCL), two FORTRAN Programs, and three MPSX Programs are required to run the model. In addition, a COBOL Report Generator is available for use in interpreting the output. The listings for these programs are presented in Appendix A. Operation of the model is a three-step process: generate the matrix, solve the mixed integer program, and write a report.

a. MPSX program A is run with the first set of JCL. The input information (as described in the Users' Manual) is processed using a FORTRAN matrix generator called from MPSX program A. A matrix in MPSX format is generated and then processed. This program can terminate (the second FORTRAN program controls this) with one of three conditions: (1) optimal solution found, (2) the specified maximum time is exceeded with the optimal continuous solution not found, or (3) the specified maximum time is exceeded with the optimal continuous solution found but the optimal mixed integer solution is not. The status of the solution is saved on tape using the problem file.

b. MPSX program B and the second set of JCL are used to resume solution if MPSX program A or B terminates before reaching an optimal continuous solution. Using the problem file the program restores the problem and continues processing until one of the three conditions described in paragraph 3-2a is again reached.

c. MPSX Program C and the third set of JCL are used to resume solution, if MPSX Program A, B, or C terminate because the maximum time is exceeded after the optimal continuous solution is found but before the optimal solution is found. Using the problem file, the program restores the problem and then proceeds to termination under one of two conditions: Optimal solution or time exceeded.
d. Once the optimal solution is found, management reports can be generated using the fourth set of JCL, MPSX program C and the COBOL report generator.

3-3. METHOD FOR OBTAINING COST-READINESS POINTS

Running the model is portrayed in Figure 6 and is described below.

a. The first phase consists of two runs. One run is done with Mode 1 with RR fixed at 1.0. This run determines the cost as well as quantities of end item and components to be procured and IPM's to be implemented to meet requirements. The other run is done in Mode 2 with the budget fixed at $0.0. This gives the current readiness (C.R.). The use of more than two significant figures for the readiness ratio is normally not meaningful in planning.

b. The second phase consists of up to three runs for intermediate points (more runs may be done if time permits or conditions require). Suggested intermediate readiness ratios to be run are given by the relation $\text{CR} + (1-\text{CR}) \times X$, where $X$ takes on the values 0.1, 0.3, and 0.6. For CR above 0.7, only the last two values should be used. The uneven spacing is suggested to provide more points where the cost-readiness relation is changing most rapidly. For intermediate readiness runs, include only those IPM's selected in the first phase. Procurement ($Q_e$) of the end item and components should be constrained by the amounts obtained for RR = 1.0 to make planning consistent with reaching 100% readiness.

c. If it is desired to obtain readiness versus cost information with the restriction that component procurement is not permitted, then the runs in the first phase must have this restriction. Intermediate runs with this restriction are then run.

3-4. ADDITIONAL INPUT CONTROLS

In addition to the input described in the Users' Manual, the analyst may use card B to specify run parameters. The card columns, format, and description are as follows:

a. Column 50 (Il) - The mode (1 or 2); default is 1.

b. Columns 51-55 (F5.3) - The readiness ratio; default is 1.0.

c. Column 56 (Il) - A scaling factor expressed as an exponent of 10. For example, 3 means all quantities will be converted to thousands; default is 0 (units).
d. Columns 57-58 (12) - Number of periods after D-day; default is 24.

e. Columns 59-68 (F100) - Limit of post-P day production permitted ($Q_p$); zero means limit to be calculated, negative means no limit; default is -1.

3-5. PROBLEM SIZE AND RUNNING TIME

Experience with the model is reported in Appendix B. For one set of data, solution time is in excess of eight hours CPU. In two others, it is in excess of one hour. MPSX is a high I/O program; execution time is normally six to ten times CPU. Therefore, it has been found prudent to run with a 60 minute internal time control after which time the problem is saved and the next segment can execute. There are two problem files in the second JCL identified as OLDFILE and PROBFILE. OLDFILE contains the status of problem used to restart and the PROBFILE contains the status of the problem at the end of the run. It is recommended that if three or more runs are required, then three tapes should be used in rotation. In that way one tape is always off the system as backup.
APPENDIX A

SOURCE LISTINGS AND JOB CONTROL LANGUAGE
SOURCE LISTINGS AND JOB CONTROL LANGUAGE

APPENDIX A

1. THIS APPENDIX CONTAINS LISTINGS FOR ALL PROGRAMS USED BY THE IA/PT MODEL. THE FOLLOWING SOFTWARE IS REQUIRED: FORTRAN, COBOL, AND MPSX.

2. A FORTRAN SUBROUTINE IS USED TO GENERATE THE MATRIX IN MPSX FORMAT. IT OPERATES ON THE INPUT DATA AS PRESCRIBED IN THE USER'S MANUAL. THIS SUBROUTINE IS CALLED BY MPSX PROGRAM A (PARAGRAPH 3 BELOW). THE PROGRAM LISTING FOLLOWS:

C THIS PROGRAM GENERATES AN INPUT LP MATRIX IN MPSX FORMAT FOR THE IA/PT MODEL. THE MODEL CONSIDERS ONE END ITEM AND MAJOR COMPONENTS. IT PERMITS CALCULATION OF TRADEOFF OF PRODUCTION WITHIN INVENTORY.
C THE PROGRAM IS DIVIDED INTO THE FOLLOWING SECTIONS:
C 1 THE INPUT IS READ IN AND SOME LIMITED CHECKING PERFORMED
C 2 THE ROWS SECTION IS WRITTEN
C 3 THE COLUMNS SECTION IS WRITTEN
C 4 THE RIGHT HAND SIDE SECTION IS WRITTEN
C 5 THE BOUNDS SECTION IS WRITTEN

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**Legend:**
- **C** = Character
- **R** = Real Number
- **D** = Dollar
- **E** = Exponent
- **T** = Time
- **H** = Holding
- **P** = Product
- **I** = Index
- **S** = Support
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<td>PERRQ</td>
<td>PEACETIME REQUIREMENTS</td>
<td>00006980</td>
</tr>
<tr>
<td>PIPEM</td>
<td>PIPE TIMES FAC</td>
<td>00007000</td>
</tr>
</tbody>
</table>
PIE - PIPELINE REQUIREMENT
PIPE - NEGATIVE OF PIPE
PLNAME - PRODUCER/LINE NAME
PNAME - PRODUCT NAME
PREQ - VALUE OF REQUIREMENTS TIMES READINESS RATIO
PRFAC - PROCUREMENT FACTOR
PROCLM - LIMIT OF PROCUREMENT (IN END ITEM EQUIVALENT)
REQ - MONTHLY REQUIREMENTS
RLEV - BUILDUP FACTOR
RINV0H - ASSETS OF PRODUCT
STORCP - STORAGE CAPACITY
TEMP - TEMPERATURE OF ALTERNATIVE, W IF WARM, C IF COLD
TITLE - TITLE OF STUDY
TITID - SHORT TITLE
YRCDR - YEARLY COSTS R TO D DAY
YRCDT - YEARLY COSTS T TO D DAY
Z - LOCATION WHERE Z STORRED, USED AS END OF FILE TEST

INITIALIZE

DOUBLE PRECISION HEAD
DIMENSION AP(99), COSTI(99), RINV0H(99), CAP(99), FICT(99), FICR(9000008500)
199, YRCDT(99), YRCDR(99), RLEV(99,32), HP(99), HL(99), HA(99), H(999998600)
2999, MPS(99), MFR(99), COSTE(99), REO(99), STORCP(99)
3 PROCML(99), TITLE17, TITID (2), CATE(2), HOLS(3), PNAME(99,5)
4 ALFA(99), PRFAC(99), PLNAME(99,5), SUSRAT(99), ALLLIN(99)
5 TEMP(99), IPMDES(99,11)
DATA 1/1M2/, BL/1H/, C/1HC/
J10=100

READING INPUT.

CARD A - TITLE OF STUDY
READ(5,400) HGL, TITLE, NUM
WRITE(6,401) NUM, HOL, TITLE
C
C CARD B - CONTROL CARD
C
READ(5,405) HOL, TITLID, NP, NA, DATE, DOLLAR, MODE, FAC, ISC, MF 1, EQ8LM, NUM
IF (MODE.EQ.0) MODE=1
IF (FAC.EQ.0.) FAC=1.
IF (MF .EQ. 0) MF=24
CC
IF (MF.LT.24) MF=MF+1
IF (EQ8LM .LE. 0) EQ8LM =-1.
WRITE(6,406) NUM, HOL, TITLID, NP, NA, DATE, DOLLAR
ITD=5
ITR=5
C
C CARD C - ASSETS MODIFICATION CARD
C
READ(5,410) HOL, ALLOW, PEREQ, ALSOS, PIPE, NUM
WRITE(6,411) NUM, HOL, ALLOW, PEREQ, ALSOS, PIPE
C
C CARD D - REQUIREMENTS
C
WRITE(6,414)
DU 10 I=1,3
READ(5,415) HOL, HOLS(I), (REQ((I-1)*8+J),J=1,8), IEXP, NUM
JI = (I-1)*8 + 1
JF = JI + 7
DU 11 J=JI,JF
10 REQ(J) = REQ(J) * 10.** IEXP
WRITE(6,416) NUM, HOL, HOLS(I), (REQ((I-1)*8+J),J=1,8)
DU 12 I=25,99
12 REQ(I) = REQ(24)
C
C CARD E - PRODUCT INFORMATION
C
DU 20 I=1,NP
READ(5,420) HUL, (PNAME(I,J),J=1,5), AP(I), RINVCH(I), COST(I), 00012400
  1 ALFAC(I), PRFAC(I), STORCP(I), NUM 00012500
  IF(STORCP(I) .LE. 0.) STORCP(I) = -1.
  IF(STORCP(I) .EQ. 1.) STORCP(I) = 0.
  PROCLM(I) = -1.
  IF(ALFAC(I) .EQ. 0.) ALFAC(I) = 1.
  IF(PRIFAC(I) .EQ. 0.) PRFAC(I) = 1.
  COST(I) = COST(I) * PRFAC(I) 00012590
20 WRITE(6,421) NUM, HUL, (PNAME(I,J),J=1,5), AP(I), RINVCH(I),
1  COST(I), ALFAC(I), PRFAC(I) 00012700
C C PRODUCTION LINE ALTERNATIVES
C
1=0
29 CONTINUE
  I=I+1
C C CARD F - PRODUCTION LINE DATA
C
READ(5,425,END=35)
  1 HOL, (PLNAME(I,J),J=1,5), HP(I), HL(I), HA(I), HS(I),
C 1 CAP(I), SUSRAT(I), ALLLIN(I), TEMP(I), NUM
  IF (ALLLIN(I) .EQ. 0.) ALLLIN(I) = 1.
  DO 21 L=1,NP
    IF (HP(I) .EQ. AP(L)) GO TO 22
21 CONTINUE
22 CONTINUE
  CAP(I) = CAP(I) * ALLLIN(I)
  1 *ALFAC(L)/PRFAC(L)
  SUSRAT(I) = SUSRAT(I) * ALLLIN(I)
  CAP(I) = CAP(I) * ALLLIN(I) 00013620
  1 *ALFAC(L)/PRFAC(L)
  IF (TEMP(I) .EQ. BL) TEMP(I) = C
20 WRITE(6,426) NUM, HOL, (PLNAME(I,J),J=1,5), HP(I), HL(I), HA(I),
1  HS(I), CAP(I), SUSRAT(I), TEMP(I) 00013700
C C CARD G - SUPPLEMENTAL INFORMATION
C
00013800
00013900
00014000
C

READ(5,430) HOL, FICT(I), YRCD(I), (IPIMDES(I,J), J=1,11), NUM
WRITE(6,431) NUM, HOL, FICT(I), YRCD(I), (IPIMDES(I,J), J=1,11)
FICR(I)=0.
YRCRD(I)=0.
C
CARD H - BUILDUP CAPABILITY
WRITE(6,434)
RLEV(I,1) = 0.
RLEV(I,2) = 0.
D0 30 J=1,3
READ (5,435) HOL, HOLS(I), (RLEV(I,(J-1)*8+K),K=3,10),IEXP,NUM
KI=(J-1)*8+1
KF=KI+7
D0 31 K=KI,KF
31 RLEV(I,K) = (RLEV(I,K)*10.**IEXP*.ALLLIN(I)
1 *ALFAC(L)/PRFAC(L)
30 WRITE (6,436) NUM, HOL, HOLS(I), (RLEV(I,(J-1)*8+K),K=1,8)
GO TO 29
35 I=I-1
IF (I.NE.NA) WRITE(6,437) I, NA
NA=I
D0 33 I=1,NA
D0 32 J=1,24
IF (RLEV(I,J) .NE. 0.) GO TO 33
32 CONTINUE
33 MPS(I) = J
D0 34 I=1,NA
D0 34 J=25,32
34 RLEV(I,J)=RLEV(I,24)
C
C WRITING ROWS PORTION OF MATRIX
C
140 I=NA
C
WRITE NAME AND ROWS CARDS AND OBJECTIVE FUNCTION

AND CONSTRAINT C-3

IF (MOD.EQ.1) WRITE (8,460)
IF (MOD.EQ.2) WRITE (8,470)

WRITE ROWS FOR CONSTRAINTS C-4 TO C-7

MFI=MFI+1
DO 150 J=1,NP
DO 150 K=1,MFI
KI=K+10
WRITE (8,480) KI, AP(J)
IF (((J.EQ.1) .OR. (K.LT. MFI))) GO TO 150
KI = MFI + 11
WRITE (8,480) KI, AP(J)
CONTINUE

WRITE ROWS FOR CONSTRAINT C-8

DO 160 J=1,NP
WRITE (8,490) AP(J)

WRITE ROWS TO SUM BUY

DO 161 J=1,NP
WRITE(8,491) AP(J)

WRITE ROWS FOR CONSTRAINT C-9

DO 165 J=1,NP
IF (PROCLM(J) .LT. 0) GO TO 165
WRITE(8,495) AP(J)
CONTINUE
C WRITE ROWS FOR CONSTRAINT C-10
C
DU 180 J=1,1
KS=MPS(J)
    IF (KS.GT.MF) KS=MF
MFA=MF+1
DU 170 K=KS,MFA
KI=K+10
170 WRITE (8,500) HP(J),HL(J),HA(J),KI
180 CONTINUE
C WRITE ROWS FOR CONSTRAINT C-11
C
DU 190 J=1,NP
IF(EQ8LM .LT. 0.) GO TO 190
WRITE (8,510) AF(J)
190 CONTINUE
C WRITE ROWS FOR CONSTRAINT C-12
C
HPC=Z
HLC=Z
DU 210 J=1,1
    IF ((HP(J).EQ.HPC).AND.(HL(J).EQ.HLC)) GO TO 200
WRITE (8,520) HP(J),HL(J)
200 HPC=HP(J)
210 HLC=HL(J)
C WRITE ROWS FOR CONSTRAINT C-13
C
DU 213 J=1,NP
    IF(STORCP(J) .LT. 0.) GO TO 213
WRITE(8,525) AP(J)
213 CONTINUE
C
WRITE ROWS FOR CONSTRAINT C-14
WRITE(8,527) AP(1)
WRITE COLUMNS PORTION OF MATRIX
WRITE HEADER
WRITE (8,530)
WRITE READINESS RATIO VARIABLE (RR)
WRITE(8,533)
MF3 = MF+1
DU 215 J=1, MF3
J11= J + 10
PREQ = -REQ(J)
WRITE(8,536) J11, AP(1), PREQ
PIPEM = -PIPE
WRITE(8,537) AP(1), PIPEM
WRITE CURRENT INVENTORY VARIABLES (Y-2)
CONTINUE
WRITE(8,538) AP(1), AP(1), AP(1)
MF1 = MF + 1
DU 221 J=1, NP
DU 221 K=1, MF1
IF (J.EQ.1 .AND. K.EQ.MF1) GO TO 221
KI=K+10
IF(STORCP(J) .LT. 0.) GO TO 220
WRITE(8,539) AP(J), KI, AP(J)
WRITE (8,540) AP(J), KI, KI, AP(J), AP(J)
CONTINUE
WRITE INVENTORY TO PROCURE VARIABLES (Y-1)
C
WRITE (8,542) AP(1), COSTI(1), AP(1)
1, AP(1), AP(1)
00027300
00027400
DU 231 J=1,NP
WRITE(8,545) AP(J), AP(J)
00027401
00027500
DU 231 K=1,MF1
IF (J.EQ.1 .AND. K.EQ.MF1) GO TO 231
00027550
00027600
KI=K+10
WRITE(8,544) AP(J), KI, AP(J)
00027650
00027700
IF(STORCP(J) .LT. 0.) GO TO 235
00027750
WRITE(8,543) AP(J), KI, AP(J)
00027800
00027900
235
IF(PROCLM(J) .LT. 0.) GO TO 229
WRITE(8,546) AP(J), KI, AP(J)
00028000
00028100
229
IF (MODE.EQ.2) GO TO 230
WRITE(8,555) AP(J), KI, COSTI(J)
00028150
00028200
230
WRITE (8,550) AP(J), KI, AP(J), AP(J), KI, COSTI(J)
00028300
00028350
231
CONTINUE
00028400
00028500
C
WRITE X AND I VARIABLES
00028600
00028700
00028800
C
WRITE PRODUCTION VARIABLES (X)
00028900
00029000
C
MSI=MPS(J)
00029100
IF (MSI.GT.MF) MSI=MF
00029150
DU 250 K=MSI,MF
00029200
KI=K+10
00029300
DU 250 L=K,MF
00029400
LI=L+10
00029500
LII=LI
00029600
IF (HS(J),NE.BL) LII=LI+1
00029700
WRITE (8,560) HP(J),HL(J),HA(J),KI,LI,HP(J),HL(J),HA(J),KI,LII,HP(00029800
1J)
00029900
MPC=Z
00030000
MFO=MF+10
00030050
DO 250 M=1,1
IF (HS(M).NE.HP(J)) GO TO 250
IF (HP(M).EQ.HPC) GO TO 240
WRITE (8,570) HP(J),HL(J),HA(J),KI,L1,KI,HP(M)
IF(KI.NE.MFO) GO TO 240
MF1=MFO+1
WRITE (8,570) HP(J), HL(J), HA(J), KI, L1, MF1, HP(M)
240 CONTINUE
MF1=MF+11
IF (HS(J).NE.BL) GO TO 261
WRITE (8,580) HP(J),HL(J),HA(J),MF1,MF1,MF1,HP(J),HP(J),HL(J),HA(J)
1),MF1
HPC=Z
MF3=MF1+1
DO 260 M=1,1
IF (HS(M).NE.HP(J)) GO TO 260
IF (HP(M).EQ.HPC) GO TO 260
WRITE (8,570) HP(J), HL(J), HA(J), MF1, MF1, MF3, HP(M)
HPC=HP(M)
260 CONTINUE
GO TO 270
261 MF1 = MF + 12
MF2 = MF + 11
WRITE (8,580) HP(J), HL(J), HA(J), MF2, MF2, MF1, HP(J), HP(J),
1 HL(J), HA(J), MF2
HPC=Z
DO 265 M=1,1
IF (HS(M).NE.HP(J)) GO TO 265
IF (HP(M).EQ.HPC) GO TO 264
WRITE (8,570) HP(J), HL(J), HA(J), MF2, MF2, MF1, HP(M)
264 HPC=HP(M)
265 CONTINUE

C WRITE CHOICE OF ALTERNATIVE VARIABLES (I) (INTEGER)
C
CONTINUE
J10=J10+1
WRITE (8,590) J10
WRITE (8,600) HP(J),HL(J),HA(J),HP(J),HL(J)
MSI=MPS(J)
IF (MSI.GT.MF) MSI=MF
DO 280 K=MS1,MF
K1=K+10
BCAP=-RLEV(J,K)
WRITE (8,630) HP(J),HL(J),HA(J),HP(J),HL(J),HA(J),K1,BCAP
MFA=MF+11
BCAP = -CAP(J)
WRITE (8,630) HP(J),HL(J),HA(J),HP(J),HL(J),HA(J),MFA,BCAP
C REWRITE FOR DISCOUNTING
C COST=FICT(J)+FICR(J)+YRCTD(J)+ITD+YKRD(J)* (ITD-ITR)
C COST=COST/10.*ISC
DO 298 L=1,NF
IF (HP(J) .EQ. AP(L)) GO TO 299
CONTINUE
CONTINUE
C COST = COST * ALLLIN(4) * ALFAC(L)/ PRFAC(L)
WRITE (8,635) HP(J),HL(J),HA(J),COST
IF (EQ8LM .GE. .0) WRITE (8,620) HP(J),HL(J),HA(J),HP(J),CAP(J)
J10=J10+1
WRITE (8,640) J10
C WRITING RHS PORTION OF MATRIX
C WRITE HEADER
C WRITE (8,650)
C WRITE RHS FOR CONSTRAINT C-3 (IF MODE 2)
C IF (MODE .EQ. 2) WRITE(8,665) DOLLAR
C WRITE RHS FOR RR (IF MODE 1)
C
IF (MODE .EQ. 2) GO TO 315
AFAC = -FAC
WRITE(8,660) AFAC
C
WRITE RHS FOR CONSTRAINT C-8
C
315 CONTINUE
DU 320 J=1, NP
WRITE (8,670) AP(J), RINVH(J)
C
WRITE RHS FOR CONSTRAINT C-9
C
DO 325 J=1, NP
IF (PROCLM(J) .LT. 0.) GO TO 325
PROCLM(J) = PROCLM(J) / 10.**ISC
WRITE(8,675) AP(J), PROCLM(J)
C
325 CONTINUE
C
WRITE RHS FOR CONSTRAINT C-11
C
IF (EWBLM .LT. 0.) GO TO 345
HPC=HP(1)
CARY=CAP(1)
DU 340 J=2,1
IF (HP(J) .NE. HPC) GO TO 330
IF (CAP(J) .LT. CARY) CARY=CAP(J)
GO TO 340
C
330 JI=J-1
CARY=CARY+REQ(MF+1) * FAC
IF (EQBLM .NE. 0.) CARY=EQBLM
WRITE (8,690) HP(JI), CARY
HPC=HP(J)
CARY=CAP(J)
340 CONTINUE
CARY=CARY+REQ(MF+1)*FAC
IF (EQ8LM.NE.0.) CARY=EQ8LM
WRITE (8,690) HP(I),CARY
C
WRITE RHS FOR CONSTRAINT C-12
C
345 HPC=Z
HLC=Z
DO 370 J=1,1
IF (HP(J).NE.HPC) GO TO 350
IF (HL(J).EQ.HLC) GO TO 360
WRITE (8,700) HP(J),HL(J)
350 HPC=HP(J)
360 HLC=HL(J)
C
WRITE RHS FOR CONSTRAINT C-13
C
DO 375 J=1,NP
IF (STORCP(J).LT.0.) GO TO 375
STORCP(J)=STORCP(J)/10**15C
WRITE(8,705) AP(J),STORCP(J)
375 CONTINUE
C
WRITE BOUNDS PORTION OF MATRIX
C
WRITE HEADER
C
377 CONTINUE
WRITE (8,710)
C
WRITE INTEGER BOUNDS
C
DO 380 J=1,1
380 WRITE (8,720) HP(J),HL(J),HA(J)
C
WRITE LOWER BOUND FOR NEGATIVE INVENTORY

PIPE = -PIPE

WRITE (8,730) AP(1), PIPE

WRITE BOUND FOR RR

CONTINUE

IF (MODE .EQ. 2) WRITE (8,735)

WRITE ENDATA CARD

WRITE (8,740)

WRITE (8,750)

IF (MODE .EQ. 1) WRITE (8,760)

IF (MODE .EQ. 2) WRITE (8,770)

WRITE (8,780) TITLID

WRITE (8,740)

REWINd 8

STOP

FORMAT STATEMENTS

INPUT FORMATS

400 FORMAT (A1, 1X, 16A4, A2, 4X, 18)
401 FORMAT (12H1 INPUT DATA:/1HO, 18, 1X, A1, 1X, 9HTITLE - ,16A4,A2)
405 FORMAT (A1, 1X, 2A4, 1X,12,1X,13,1X,A4, A3, 1X, F15.0, 8X, 11,
1 F5.3, 11, 12, F10.0, 4X, 18)
406 FORMAT (1HO, 18, 1X, A1, 1X, 14HS IRT TITLE - ,2A4,
1 23H, NUMBER OF PRODUCTS - , 12, 26H, NUMBER OF ALTERNATIVES - ,
2 12, 29H, START OF PLANNING PERIOD - , A4, A3/ 12X,
3 10HBUDGET - $, F15.0)
410 FORMAT (A1, 1X, 4(F10.0, 1X), 26X, 18)
411 FORMAT (1HO, 18, 1X, A1, 22H INITIAL ALLOWANCES - , F10.0,
1 27H, PEACETIME REQUIREMENTS - , F10.0, 11H, LOSSES - , F10.0/
2 12X, 24HPIPELINE REQUIREMENTS - , F10.0)
414 FORMAT (1HO, 11X, 13HREQUIREMENTS:)
415 FORMAT (2A1, 8F8.0, 1X, I1, 4X, I8)
416 FORMAT (1X, I8, 1X, 2A1, 8(I1X, F14.0))
420 FORMAT (A1, 1X, 5A4, 1X, A1, 2(I1X, F10.0), 1X, F10.8, 1X, F10.4
1, F8.0, 14)
421 FORMAT (1HO, I8, 1X, A1, 1X, 10HPRODUCT - , 5A4, 9H, CODE - , A1,
1 22H, INVENTORY ON HAND - , F10.0, 23H, AVERAGE UNIT COST - $,
2 F10.2/ 12X, 20HALLOCATION FACTOR - , F10.8,
3 23H, PROCUREMENT FACTOR - , F10.6)
425 FORMAT (A1, 1X, 5A4, 1X, 4A1, 2(I1X, F10.0), 1X, F5.3, 1X, A1, 15X, 18)
426 FORMAT (1HO, I8, 1X, A1, 1X, 16HPRODUCER/LINE - , 5A4,
1 33H, CODES IDENTIFYING ALTERNATIVE - , 4A1/ 12X,
2 19HMAXIMUM CAPACITY - , F10.0, 27H, MINIMUM SUSTAINING RATE - ,
3 F10.0, 16H, TEMPERATURE - , A1)
430 FORMAT (A1, 1X, 2(F10.0,1X), 11A4, 4X, I8)
431 FORMAT (1H , I8, 1X, A1, 1X, 17HUNE TIME COST - $, F10.0,
1 17H, ANNUAL COST - $, F10.0, 16H, DESCRIPTION - , 11A4)
434 FORMAT (1H , 11X, 20HBUILDUP CAPABILITY: )
435 FORMAT (2A1, 8F8.0, 1X, I1, 4X, I8)
436 FORMAT (1X, I8, 1X, 2A1, 8(I1X, F14.0))
437 FORMAT (1HO, 12, ALTERNATIVES READ IN ' , 12, ALTERNATIVES ')
1 'SPECIFIED IN INPUT. ADJUSTMENTS MADE FOR PROCESSING.')

C C ROWS FORMATS
C C
460 FORMAT (4HNAME, 10X, 5HBLOCK/ 4HROWS/ 8H N COST/,
1 11H N ADDCOST/ 6H L RR)
470 FORMAT (4HNAME, 10X, 5HBLOCK/ 4HROWS/ 8H N RR /, 8H L COST)
480 FORMAT (5H G, 12, A1)
490 FORMAT (9H L INVH0, A1)
491 FORMAT (7H E BUY, A1)
495 FORMAT (8H L PROC, A1)
500 FORMAT (6H L PW, 3A1, 1HM, 12)
510 FORMAT (9H L PLSTP, 1A1)
3. MPSX program A reads the matrix generated by the FORTRAN subroutine. It then proceeds until reaching an optimal solution or reaching an internal time control at which point it saves the
STATUS OF THE PROBLEM:

PROGRAM('ND')
INITIALZ
TITLE('JCAP IA/PT MODEL - INITIAL RUN')
WRITE('START TIMERB')
WRITE('START IAPTMG')
MOVE(XDATA,'BLOCK')
MOVE(XPBNAM,'PBFILE')
convert('FILE','MATRIX')
MVADR(XDDELTM,JUMP)
MOVE(XDATA,'BLOCKCTL')
READ('FILE','MATRIX')
SETUP('BOUND','BOUND')
MOVE(XDATA,'BLOCKB')
MOVE(XRHS,'CONSTR')
XFREQLG=1000000
PRIMAL
X_INIMIX
MVADR(XDPRINT,CONT)
MVADR(XDDELTM,JUMP)
MVADR(XDOPRIM,A)
MIXSTART('COST')
MIXFLOW
MIXSAVE
MIXSTATS
SOLUTION('ACTIVE')
EXIT
JUMP
INVERT
SAVE

00000100
00007900
00008000
00008005
00008010
00008015
00008020
00008025
00008030
00008100
00008200
00008300
00008500
00008600
00008700
00008800
00008900
00009000
00009100
00009200
00009300
00009305
00009310
00009315
00009320
00009330
00009340
00009350
00009400
00009500
00009900
00010000
EXIT
JUMP!  MIXSAVE
MIXSTATS
EXIT
CONTINUE
A XINVERT=1
INVERT
XOINES=O
PRIMAL
XINVERT=O
MVADR(XOINES,B)
CONTINUE
B MIXSAVE
MIXSTATS
EXIT
PEND

4. MPSX PROGRAM B RESUMES WITH A PROBLEM WHERE THE CONTINUOUS
OPTIMAL SOLUTION HAS NOT BEEN FOUND AND PROCEEDS UNTIL REACHING
AN OPTIMAL SOLUTION OR REACHING AN INTERNAL TIME CONTROL AT WHICH
POINT IT Saves THE PROBLEM:

PROGRAM('ND')
INITIALZ
TITLE('JCAP 1A/PT MODEL - RESUME IN CONTINUOUS PHASE')
WRITE('START TIMERB')
TIMERB(XDELTM)
TYPE('JCAP 1A/PT MODEL RUN - UP TO ', XDELTM, 'MIN CP TIME')
MOVE(XDATA,'BLOCK')
MOVE(XPBNAMc,'PBFILE')
MOVE(XOLDNAME,'PBFILE')
COPY('ENTIRE')
MVADR(XDODELM,JUMP)
SETUP('BOUND','BOUND')
RESTORE('STATUS')
MOVE(XDATA,'BLOCKB')
XPREQLGO=1000000
PRIMAL
INIMIX
  MVADR(XDOPRINT,CONT)
MVADR(XDODELM,JUMPI)
MVADR(XDOPRIM,A)
MIXSTART('COST')
MIXFLOW
MIXSAVE
MIXSTATS
SOLUTION('ACTIVE')
EXIT
JUMP
INVERT
SAVE
EXIT
JUMPI
MIXSAVE
MIXSTATS
EXIT
CONT
CONTINUE
A
XINVERT=1
INVERT
XUNFS=0
PRIMAL
XINVERT=0
MVADR(XDUNFS,B)
CONTINUE
B
MIXSAVE
MIXSTATS
EXIT
PEND
5. MPSX PROGRAM C RESUMES WITH A PROBLEM IN THE INTEGER TREE SEARCH AND PROCEEDS UNTIL REACHING AN OPTIMAL SOLUTION OR REACHING AN INTERNAL TIME CONTROL AT WHICH POINT IT SAVES THE STATUS OF THE PROBLEM:

```
PROGRAM('NO')
INITIAL
TITLE('JCAP IA/PT MODEL - RESUME IN MIP PHASE')
WRITE('START TIMERS')
TIMERR(XDELTM)
TYPE('JCAP IA/PT MODEL RUN - UP TO ', XDELTM, 'MIN CP TIME')
MOVE(XDATA,'BLOCK')
MOVE(XPBNAME,'PBFILE')
MOVE(XOLDNAME,'PBFILE')
COPY('ENTIRE')
SETUP('BOUND','BOUND')
MOVE(XDATA,'BLOCK')
XFREQLGO=100000
INMIX
MVADR(XORDPRINT,CONT)
MVADR(XDODELTM,JUPM)
MVADR(XDODELTM,A)
MIXSTART('RESTORE')
MIXFLOW
MIXSAVE
MIXSTATS
SOLUTION('ACTIVE')
EXIT
JUPM
EXIT
```
CONT CONTINUE A
XINVERT=1 00010230
INVERT 00010240
XDGNS=O 00010250
PRIMAL 00010260
XINVERT=O 00010270
MVADR(XDGNS,B) 00010280
CONTINUE 00010290
B
MIXSAVE 00010300
MIXSTATS 00010310
EXIT 00010320
PEND 00010330

6. THE FOLLOWING COBOL PROGRAM READS THE MPSX OUTPUT AND
GENERATES A REPORT. FOR DETAILS SEE THE USERS' MANUAL.

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID. 'RPTGN'.
000300 AUTHOR. SCHWEGLER.
000400 ENVIRONMENT DIVISION.
000500 CONFIGURATION SECTION.
000600 SPECIAL-NAMES.
000700 CO1 IS NEXT-PAGE.
000800 INPUT-OUTPUT SECTION.
000900 FILE-CONTROL.
001000 SELECT GLOSSARY-IN ASSIGN TO UT-S-GLOSSARY.
001100 SELECT DATA-IN ASSIGN TO UT-S-DATA.
001200 SELECT OUTPUT-FILE ASSIGN TO UT-S-PRINT.
001300 DATA DIVISION.
001400 FILE SECTION.
001500 FD DATA-IN.
001600 DATA RECORDS ARE DISC-REC, SEARCH-REC,
001700 RECORDING MODE IS F,
001800 BLOCK CONTAINS 0 RECORDS.
001900 LABEL RECORDS ARE STANDARD.
002000 01 DISC-REC.
002100 02 FILLER PIC X(10).
002200 02 IX-Y-CODE PIC X.
002300 02 PLANT-CODE.
002400 03 ITEM-MADE PIC X.
002500 03 FILLER PIC XX.
002600 02 CODE-FIELD REDEFINES PLANT-CODE.
002700 03 FILLER PIC X.
002800 03 INV-CODE PIC X.
002900 03 ITEM-CODE PIC X.
003000 02 MONTH-USE PIC 99.
003100 02 PROD-MONTH REDEFINES MONTH-USE PIC 99.
003200 02 UTIL-MONTH PIC 99.
003300 02 FILLER PIC X(6).
003400 02 INPUT-REC.
003500 03 ACT-INT PIC X(7).
003600 03 ACT OCCURS 6 TIMES PIC X.
003700 02 ACT-SIGN PIC X.
003800 02 FILLER PIC X(95).
003900 01 SEARCH-REC.
004000 02 FILLER PIC X.
004100 02 START-FILE PIC X(19).
004200 02 END-FILE REDEFINES START-FILE.
004300 03 END-KEY PIC X(12).
004400 03 FILLER PIC X(7).
004500 02 FILLER PIC X(113).
004600 FD OUTPUT-FILE
004700 DATA RECORD IS PRINT-OUT,
004800 RECORDING MODE IS F,
004900 LABEL RECORD IS OMITTED.
005000 01 PRINT-OUT PIC X(133).
005100 FD GLOSSARY-IN
005200 DATA RECORDS ARE A-CARD, B-CARD, C-CARD, D1-CARD, D2-CARD,
005300 D3-CARD, E-CARD, F-CARD, G-CARD, H1-CARD, H2-CARD, H3-CARD,
009000 02 PIPE-REQ2 REDEFINES PIPE-REQ1 PIC 9(10).
009100 02 FILLER PIC X(35).
009200 01 D1-CARD.
009300 02 CC-D1 PIC XX.
009400 02 D1-MCR LCCURS 8 TIMES PIC X(8).
009500 02 FILLER PIC X.
009600 02 EC-D11 PIC X.
009700 02 EC-D12 REDEFINES EC-D11 PIC 9.
009800 02 FILLER PIC X(12).
009900 01 D2-CARD.
010000 02 CC-D2 PIC XX.
010100 02 D2-MCR LCCURS 8 TIMES PIC X(8).
010200 02 FILLER PIC X.
010300 02 EC-D21 PIC X.
010400 02 EC-D22 REDEFINES EC-D21 PIC 9.
010500 02 FILLER PIC X(12).
010600 01 D3-CARD.
010700 02 CC-D3 PIC XX.
010800 02 D3-MCR LCCURS 8 TIMES PIC X(8).
010900 02 FILLER PIC X.
011000 02 EC-D31 PIC X.
011100 02 EC-D32 REDEFINES EC-D31 PIC 9.
011200 02 FILLER PIC X(12).
011300 01 E-CARD.
011400 02 CC-E PIC X.
011500 02 FILLER PIC X.
011600 02 PROD-NAME PIC X(20).
011700 02 FILLER PIC X.
011800 02 PROD-CODE PIC X.
011900 02 FILLER PIC X.
012000 02 ASSETS-ON-HAND1 PIC X(10).
012100 02 ASSETS-ON-HAND2 REDEFINES ASSETS-ON-HAND1 PIC 9(10).
012200 02 FILLER PIC X.
012300 02 UNIT-COST1 PIC X(5).
012400 02 FILLER PIC X.
012500 02 UNIT-COST2 PIC XXXXX.
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016200  02 FILLER  PIC X.
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016400  02 A-IPM-CLST2 REDEFINES A-IPM-CLST1 PIC 9(10).
016500  02 FILLER  PIC X.
016600  02 IPM-DESC  PIC X(44).
016700  02 FILLER  PIC X(12).
016800  01 H1-CARD.
016900  02 CC-H1  PIC XX.
017000  02 PROD-BU-H1 OCCURS 8 TIMES PIC X(8).
017100  02 FILLER  PIC X.
017200  02 EC-H11  PIC X.
017300  02 EC-H12 REDEFINES EC-H11 PIC 9.
017400  02 FILLER  PIC X(12).
017500  01 H2-CARD.
017600  02 CC-H2  PIC XX.
017700  02 PROD-BU-H2 OCCURS 8 TIMES PIC X(8).
017800  02 FILLER  PIC X.
017900  02 EC-H21  PIC X.
018000  02 EC-H22 REDEFINES EC-H21 PIC 9.
018100  02 FILLER  PIC X(12).
018200  01 H3-CARD.
018300  02 CC-H3  PIC XX.
018400  02 PROD-BU-H3 OCCURS 8 TIMES PIC X(8).
018500  02 FILLER  PIC X.
018600  02 EC-H31  PIC X.
018700  02 EC-H32 REDEFINES EC-H31 PIC 9.
018800  02 FILLER  PIC X(12).
018900  WORKING-STORAGE SECTION.
019000  77 STORAGE-START PIC X(27) VALUE 'WORKING STORAGE STARTS HERE'.
019100  77 PREV-ITEM PIC X VALUE SPACES.
019200  77 PREV-INV-CUDE PIC X VALUE SPACES.
019300  77 SWITCH-A PIC XXX VALUE 'ON'.
019400  77 SWITCH-B PIC XXX VALUE 'ON'.
019500  77 SWITCH-C PIC XXX VALUE 'ON'.
019600  77 SWITCH-D PIC XXX VALUE 'ON'.
019700  77 SWITCH-E PIC XXX VALUE 'ON'.
019800  77  SWITCH-F  PIC  XXX  VALUE  'ON'.
019900  77  SWITCH-G  PIC  XXX  VALUE  'ON'.
020000  77  PLANT-CTR  PIC  99  VALUE  0.
020100  77  MONTH-CTR  PIC  99  VALUE  0.
020200  77  ITEM-CTR1  PIC  99  VALUE  0.
020300  77  NO-OF-ITEMS1  PIC  99  VALUE  0.
020400  77  ITEM-CTR2  PIC  99  VALUE  0.
020500  77  NO-OF-ITEMS2  PIC  99  VALUE  0.
020600  77  NO-OF-ITEMS PIC  99  VALUE  0.
020700  77  NO-OF-PLANTS PIC  99  VALUE  0.
020800  77  NO-OF-MONTHS PIC  99  VALUE  0.
020900  77  PREV-PLANT PIC  XXX  VALUE  SPACES.
021100  77  GLOSSARY-CTR PIC  99  VALUE  0.
021200  77  GLOSSARY-MAX PIC  99  VALUE  0.
021300  77  SUB1 PIC  99  VALUE  0.
021400  77  SUB2 PIC  99  VALUE  0.
021500  77  SUB3 PIC  99  VALUE  0.
021600  77  SUB4 PIC  99  VALUE  0.
021700  77  SUB5 PIC  99  VALUE  0.
021800  77  DEC-CHECK PIC  99  VALUE  0.
021900  77  DEC-COUNT PIC  99  VALUE  0.
022000  77  ZERO-COUNT PIC  99  VALUE  0.
022100  77  CTR1 PIC  99  VALUE  0.
022200  77  CTR2 PIC  99  VALUE  0.
022300  77  CTR3 PIC  99  VALUE  0.
022400  77  MULTIPLIER PIC  99  VALUE  0.
022500  77  LINE-TOTAL1 PIC  9(6)V99 VALUE  0.
022600  77  LINE-TOTAL2 PIC  9(6)V99 VALUE  0.
022700  77  VAR1 PIC  99  VALUE  0.
022800  77  VAR2 PIC  99  VALUE  0.
022900  77  TOTAL-REQUIREMENTS PIC  9(6)V99 VALUE  0.
023000  77  TABLE-CTR PIC  99  VALUE  0.
023100  77  GRAND-TOTAL PIC  9(12) VALUE  ZERO.
023200  77  TOTAL-ITEM-COST PIC  9(10) VALUE  0.
023300  77  TOTAL-PLAN-COST PIC  9(11) VALUE  0.
023400 77 IPM-TOTAL-COST PIC 9(9)V99 VALUE 0.
023500 77 IPM-COST PIC 9(9)V99 VALUE 0.
023600 77 NO-OF-ALTERNATIVES PIC 99 VALUE 0.
023700 77 TITLE-OF-STUDY PIC X(66) VALUE SPACES.
023800 77 SHORT-TITLE PIC X(8) VALUE SPACES.
023900 77 FYDP-START PIC X(7) VALUE SPACES.
024000 77 FY-BUDGET PIC 9(15) VALUE 0.
024100 77 INITIAL-ALLOWANCES PIC 9(10) VALUE 0.
024200 77 PEACE-REQUIREMENT PIC 9(10) VALUE 0.
024300 77 LOSSES-GONE PIC 9(10) VALUE 0.
024400 77 PIPELINE-REQUIREMENT PIC 9(10) VALUE 0.
024600 77 COST-CHECK PIC 9(12) VALUE 0.
024600 77 STORAGE-END PIC X(25) VALUE 'WORKING STORAGE ENDS HERE'.
024700 01 ACTIVITY-NG.
024800 02 BASE-ACT.
024900 03 ACT-INT-NU PIC X(7).
025000 03 ACT-ND OCCURS 6 TIMES PIC X.
025100 02 ACTIVITY1 REDEFINES BASE-ACT PIC 9(7)V9(6).
025200 02 ACTIVITY2 REDEFINES BASE-ACT PIC 9(8)V9(5).
025300 02 ACTIVITY3 REDEFINES BASE-ACT PIC 9(9)V9(4).
025400 02 ACTIVITY4 REDEFINES BASE-ACT PIC 9(10)V999.
025500 02 ACTIVITY5 REDEFINES BASE-ACT PIC 9(11)V99.
025600 02 ACTIVITY6 REDEFINES BASE-ACT PIC 9(10)V9.
025700 02 ACTIVITY7 REDEFINES BASE-ACT PIC 9(13).
025800 01 TABLE-NUMBER-LINE.
025900 02 TABLE-WRD PIC X(68) VALUE 'TABLE' JUSTIFIED RIGHT.
026000 02 TABLE-NUM PIC Z9.
026100 02 FILLER PIC X(62) VALUE SPACES.
026200 01 SUMMARY-UTIL-TOTALS.
026300 02 ITEM-UTIL OCCURS 20 TIMES.
026400 03 ITEM-MONTH-UTIL OCCURS 26 TIMES PICTURE 9(8).
026500 01 SUMMARY-TOTALS.
026600 02 ITEM-SUMMARY OCCURS 20 TIMES.
026700 03 ITEM-MONTH-TOTAL OCCURS 26 TIMES PIC 9(8).
026800 01 SUMMARY-GRAND-TOTALS.
026900 02 ITEM-GRAND-TOTAL OCCURS 20 TIMES PIC 9(6)V99.
030600  02 FILLER PIC X(34) VALUE 'ITEM' JUSTIFIED RIGHT.
030700  02 FILLER PIC X(25) VALUE 'UNIT COST' JUSTIFIED RIGHT.
030800  02 FILLER PIC X(15) VALUE 'BUY QUANTITY' JUSTIFIED RIGHT.
030900  02 FILLER PIC X(18) VALUE 'TOTAL ITEM COST' JUSTIFIED RIGHT.
031000  02 FILLER PIC X(41) VALUE SPACES.
031100  01 IA-PT-BUY-LINE.
031200  02 FILLER PIC X(28) VALUE SPACES.
031300  02 IA-PT-NAME PIC X(20).
031400  02 FILLER PIC X(2) VALUE SPACES.
031500  02 IA-PT-COST PIC $ZZZ9999.
031600  02 FILLER PIC X(2) VALUE SPACES.
031700  02 IA-PT-BUY PIC ZZ,ZZZ,ZZ9.
031800  02 FILLER PIC X(4) VALUE SPACES.
031900  02 TOTAL-IA-PT-ITEM-COST PIC $ZZ,ZZZ,ZZZ,ZZ9.
032000  02 FILLER PIC X(40) VALUE SPACES.
032100  01 IA-PT-TOTAL-PLAN-COST.
032200  02 FILLER PIC X(76) VALUE 'THE COST FOR THE PROCUREMENT PLAN
032300-  'IS ' JUSTIFIED RIGHT.
032400  02 IA-PT-TOTAL-PLAN-OUT PIC $ZZ,ZZZ,ZZZ,ZZ9.
032500  02 FILLER PIC X(42) VALUE SPACES.
032600  01 ASSETS-TO-BUY-TOTALS.
032700  02 TOTAL-ASSETS-TO-BUY OCCURS 50 TIMES PIC 9(8).
032800  01 PROD-UTIL-TABLE.
032900  02 PROD-UTIL-USE OCCURS 50 TIMES.
033000  03 PROD-UTIL-MONTH OCCURS 26 TIMES.
033100  04 ELEM OCCURS 2 TIMES PIC 9(8).
033200  01 PROD-UTIL-TABLE-ZERO REDEFINES PROD-UTIL-TABLE PIC X(20000).
033300  01 UTIL-TOTALS-TABLE.
033400  02 TOTAL-UTIL OCCURS 50 TIMES PIC 9(8).
033500  01 PROD-TOTALS-TABLE.
033600  02 TOTAL-PROD OCCURS 50 TIMES PIC 9(8).
033700  01 ERR-MESSI.
033800  02 FILLER PIC X(10) VALUE SPACES.
033900  02 FILLER PIC X(24) VALUE 'ERROR IN PRODUCT-SEARCH1'.
034000  02 FILLER PIC X(99) VALUE SPACES.
034100  01 ERR-MESS2.
034200 02 FILLER PIC X(10) VALUE SPACES.
034300 02 FILLER PIC X(25) VALUE 'RECEIVING FIELD TOO SMALL'.
034400 02 FILLER PIC X(97) VALUE SPACES.
034500 01 ERR-MESS3.
034600 02 FILLER PIC X(5) VALUE SPACES.
034700 02 FILLER PIC X(75) VALUE 'REPORT WRITER TOTAL COST DIFFERS FROM MPSX TOTAL COST BY MORE THAN 10 UNITS'.
034800 02 FILLER PIC X(53) VALUE SPACES.
035000 01 ERR-MESS4.
035100 02 FILLER PIC X(10) VALUE SPACES.
035200 02 FILLER PIC X(14) VALUE 'ERROR IN LOOP2'.
035300 02 FILLER PIC X(109) VALUE SPACES.
035400 01 IPM-HD1.
035500 02 FILLER PIC X(89) VALUE 'INDUSTRIAL PREPAREDNESS MEASURES SELECTED FOR JUSTIFIED RIGHT'.
035600 02 IPM-HD1-ITEM PIC X(20).
035700 02 FILLER PIC X(24) VALUE SPACES.
035900 01 IPM-HD4.
036000 02 FILLER PIC X(8) VALUE 'PLANT' JUSTIFIED RIGHT.
036100 02 FILLER PIC X(14) VALUE 'PRODUCT' JUSTIFIED RIGHT.
036200 02 FILLER PIC X(18) VALUE 'ONE-TIME-COST' JUSTIFIED RIGHT.
036300 02 FILLER PIC X(16) VALUE 'ANNUAL-COST' JUSTIFIED RIGHT.
036400 02 FILLER PIC X(18) VALUE 'TOTAL-IPM-COST' JUSTIFIED RIGHT.
036500 02 FILLER PIC X(21) VALUE 'DESCRIPTION OF IPM' JUSTIFIED RIGHT.
036600 02 FILLER PIC X(38) VALUE SPACES.
036800 02 FILLER PIC X(38) VALUE SPACES.
036900 01 IPM-LINE.
037000 02 FILLER PIC X VALUE SPACES.
037100 02 PLANT-T PIC X(10).
037200 02 FILLER PIC XXX VALUE SPACES.
037300 02 PRODUCT-T PIC X(10).
037400 02 FILLER PIC XXX VALUE SPACES.
037500 02 DTC PIC $Z,ZZZ,ZZZ,ZZ9.
037600 02 FILLER PIC X(3) VALUE SPACES.
037700 02 AC PIC $Z,ZZZ,ZZZ,ZZ9.
037800 02 FILLER PIC XXX VALUE SPACES.
037900 02 IPM-TC PIC $Z,ZZZ,ZZZ,ZZ9.
038000 02 FILLER PIC XXX VALUE SPACES.
038100 02 IPM-NOTE1 PIC X(22).
038200 02 FILLER PIC X(33) VALUE SPACES.
038300 01 IPM-LINE2.
038400 02 FILLER PIC X VALUE SPACES.
038500 02 PLANT-T2 PIC X(10).
038600 02 FILLER PIC XX VALUE SPACES.
038700 02 PRODUCT-T2 PIC X(10).
038800 02 FILLER PIC X(54) VALUE SPACES.
038900 02 IPM-NOTE2 PIC X(22).
039000 02 FILLER PIC X(33).
039100 01 IPM-COST-LINE.
039200 02 FILLER PIC X(80) VALUE 'THE COST FOR ALL INDUSTRIAL PREPAR
039300 - *EDNESS MEASURES SELECTED IS ' JUSTIFIED RIGHT.
039400 02 IPM-AMT PIC $ZZ,ZZZ,ZZZ,ZZ9.
039500 02 FILLER PIC X(40) VALUE SPACES.
039600 01 GRAND-TOTAL-LINE.
039700 02 FILLER PIC X(80) VALUE 'THE TOTAL COST FOR THE IA/PT SOLUT
039800 - *ION IS ' JUSTIFIED RIGHT.
039900 02 GRAND-AMT PIC $ZZ,ZZZ,ZZZ,ZZ9.
040000 02 FILLER PIC X(37) VALUE SPACES.
040100 01 MODU-REQU-REQUIRE-TABLE.
040200 02 MODU-REQ OCCURS 25 TIMES PIC 9(8).
040300 01 PRODUCTS-TABLE.
040400 02 PRODUCTS-LIST OCCURS 10 TIMES.
040500 03 PRODUCT PIC X(20).
040600 03 PRODUCT-CODE PIC X.
040700 03 PRODUCT-ASSETS PIC 9(10).
040800 03 PRODUCT-UNIT-COST PIC 9(5)V9999.
040900 03 PRODUCT-ALLOC-FACOR PIC 9V999.
041000 03 PROCURE-FACTOR PIC 9(16)V9999.
041100 01 PLANT-TABLE.
041200 02 PLANT-LIST OCCURS 20 TIMES.
041300 03 APRDL-LINE PIC X(20).
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<td>042200</td>
<td>03 ABASE-TEMP PIC X.</td>
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<td>042300</td>
<td>03 ALT-IPM-COSTS PIC 9(10).</td>
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<td>042400</td>
<td>03 AA-IPM-COSTS PIC 9(10).</td>
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<td>042500</td>
<td>03 AIPM-DESC PIC X(44).</td>
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<td>042600</td>
<td>03 ABUILD-UP OCCURS 25 TIMES PIC 9(8).</td>
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<td>042700</td>
<td>01 GLOSSARY-TABLE.</td>
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<td>042800</td>
<td>02 GLIST OCCURS 50 TIMES.</td>
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<td>042900</td>
<td>03 ITEM-SYMBOL PIC X.</td>
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<td>03 ITEM-NAME.</td>
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<td>04 ITEM-NAME1 PIC X(10).</td>
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<td>04 ITEM-NAME2 PIC X(10).</td>
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<td>03 PLANT-SYMBOL PIC XXX.</td>
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<td>04 PLANT-NAME2 PIC X(10).</td>
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<td>03 ITEM-UNIT-COST PIC 9(5)V9999.</td>
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<td>03 ONE-TIME-COST PIC 9(10).</td>
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<td>03 ANNUAL-COST PIC 9(10).</td>
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<td>04 IPM-DESCRIPTION1 PIC X(22).</td>
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<td>04 IPM-DESCRIPTION2 PIC X(22).</td>
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<td>03 IPM-CODE PIC X.</td>
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<td>044400</td>
<td>01 UNIT-COST-JOIN.</td>
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<td>044500</td>
<td>02 UC-STORE.</td>
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<td>044600</td>
<td>03 UC-PART1 PIC X(5).</td>
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<td>044700</td>
<td>03 UC-PART2 PIC XXX.</td>
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<td>044800</td>
<td>02 UC-DUM REDEFINES UC-STORE PIC 9(5)V9999.</td>
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<td>044900</td>
<td>01 ALLOC-FAC-JOIN.</td>
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045000 02 AF-STURE.
045100 03 AF-PART1 PIC X.
045200 03 AF-PART2 PIC XXX.
045300 02 AF-DUM REDEFINES AF-STURE PIC 9V999.
045400 01 PROC-FAC-JOIN.
045500 02 PF-STOR.
045600 03 PF-PART1 PIC X(6).
045700 03 PF-PART2 PIC XXX.
045800 02 PF-DUM REDEFINES PF-STORE PIC 9(6)V999.
045900 01 NEW-FORM.
046000 02 ALPHA PIC X(8).
046100 02 NUM REDEFINES ALPHA PIC 9(8).
046200 01 PAGE-HEADING.
046300 02 FILLER PIC X(44) VALUE SPACES.
046400 02 PAGE-TITLE PIC X(66).
046500 02 FILLER PIC X(23) VALUE SPACES.
046600 01 GLOSSARY-CHECK.
046700 02 FILLER PIC X(5) VALUE SPACES.
046800 02 GLOSS-OUT.
046900 03 ITEM-INFO PIC X(21).
047000 03 PLANT-INFO PIC X(23).
047100 03 COST-INFO.
047200 04 INFO1 PIC 9(10).
047300 04 INFO2 PIC 9(10).
047400 04 INFO3 PIC 9(10).
047500 03 IPM-INFO PIC X(45).
047600 02 FILLER PIC X(9) VALUE SPACES.
047700 01 ITEM1-CHECK.
047800 02 FILLER PIC X(10) VALUE SPACES.
047900 02 ITEM1-OUT PIC X.
048100 02 FILLER PIC X(122) VALUE SPACES.
048200 PROCEDURE DIVISION.
048300 OPN INPUT GLOSSARY-IN, OUTPUT OUTPUT-FILE.
048300 MOVE SPACES TO PRODUCTS-TABLE.
048400 MOVE SPACES TO PLANT-TABLE.
048500 MOVE SPACES TO GLOSSARY-TABLE.
048510* INPUT-READ THRU ED01 ESTABLISHES THE GLOSSARY-TABLE USED TO
048520* TRANSLATE THE CODES USED IN THE MPSX PROGRAM.
048600 INPUT-READ.
048700 READ GLOSSARY-IN AT END GO TO NEXT-STEP.
048800 IF CC-A = 'A' MOVE STUDY-TITLE TO PAGE-TITLE.
048900 IF CC-A = 'A' MOVE STUDY-TITLE TO TITLE-OF-STUDY GO TO
049000 INPUT-READ.
049100 IF CC-B = 'B' MOVE TITLE-ID TO SHORT-TITLE
049200 EXAMINE NO-PROD1 REPLACING ALL '' BY '0'
049300 MOVE NO-PROD2 TO NO-OF-ITEMS
049400 EXAMINE NO-ALT1 REPLACING ALL '' BY '0'
049500 MOVE NO-ALT2 TO NO-OF-ALTERNATIVES MOVE
049600 FYDP-DATE TO FYDP-START EXAMINE FY-BUD1 REPLACING ALL ''
049700 BY '0' MOVE FY-BUD2 TO FY-BUDGET GO TO
049800 INPUT-READ.
049900 IF CC-C = 'C' EXAMINE INT-ALLOW1 REPLACING ALL '' BY '0'
050000 MOVE INT-ALLOW2 TO INITIAL-ALLOWANCES
050100 EXAMINE PEACE-REQ1 REPLACING ALL '' BY '0'
050200 MOVE PEACE-REQ2 TO PEACE-REQUEST
050300 EXAMINE LOSSES1 REPLACING ALL '' BY '0'
050400 MOVE LOSSES2 TO LOSSES-GONE
050500 EXAMINE PIPE-REQ1 REPLACING ALL '' BY '0'
050600 MOVE PIPE-REQ2 TO PIPELINE-REQUEST GO TO INPUT-READ.
050700 IF CC-D1 = 'D1' MOVE O TO CTR2 PERFORM REQ-ROUT THRU
050800 REQ-EXIT VARYING CTR1 FROM 1 BY 1 UNTIL CTR1 > 8.
050900 IF CC-D1 = 'D1' GO TO INPUT-READ.
051000 IF CC-D2 = 'D2' PERFORM REQ-ROUT THRU REQ-EXIT VARYING
051100 CTR1 FROM 1 BY 1 UNTIL CTR1 > 8.
051200 IF CC-D2 = 'D2' GO TO INPUT-READ.
051300 IF CC-D3 = 'D3' PERFORM REQ-ROUT THRU REQ-EXIT VARYING
051400 CTR1 FROM 1 BY 1 UNTIL CTR1 > 8.
051500 IF CC-D3 = 'D3' MOVE O TO CTR1 GO TO INPUT-READ.
051600 IF CC-E = 'E' PERFORM E-ROUT.
051700 IF CC-E = 'E' GO TO INPUT-READ.
051800 IF CC-F = 'F' AND SWITCH-A = 'ON'
051900 MOVE CTR2 TO NO-OF-MONTHS
052000  MOVE 0 TO CTR2
052100  MOVE 0 TO CTR1
052200  MOVE 'OFF' TO SWITCH-A.
052300  IF CC-F = 'F' AND SWITCH-A = 'OFF' PERFORM F-ROUT.
052400  IF CC-F = 'F' AND SWITCH-A = 'OFF' GO TO INPUT-READ.
052500  IF CC-G = 'G' PERFORM G-ROUT.
052600  IF CC-G = 'G' GO TO INPUT-READ.
052700  IF CC-H1 = 'H1' PERFORM BU-ROUT THRU BU-EXIT VARYING CTR1
052800  FROM 1 BY 1 UNTIL CTR1 > 8.
052900  IF CC-H1 = 'H1' GO TO INPUT-READ.
053000  IF CC-H2 = 'H2' PERFORM BU-ROUT THRU BU-EXIT VARYING CTR1
053100  FROM 1 BY 1 UNTIL CTR1 > 8.
053200  IF CC-H2 = 'H2' GO TO INPUT-READ.
053300  IF CC-H3 = 'H3' PERFORM BU-ROUT THRU BU-EXIT VARYING CTR1
053400  FROM 1 BY 1 UNTIL CTR1 > 8.
053500  IF CC-H3 = 'H3' GO TO INPUT-READ.
053510  *NEXT-STEP THRU PRODUCT-SEARCH2 MOVES DATA FROM AUXILLARY
053520  *STORAGE AREAS INTO THE GLOSSARY-TABLE.
053600  NEXT-STEP.
053700  MOVE NO-OF-ALTERNATIVES TO GLOSSARY-MAX.
053800  MOVE NO-OF-ALTERNATIVES TO NO-OF-PLANTS.
053900  MOVE 0 TO CTR1.
054000  MOVE 0 TO CTR2.
054100  MOVE 0 TO CTR3.
054200  GLOSSARY-ROUT.
054300  ADD 1 TO CTR2.
054400  MOVE APROD-LINE (CTR2) TO PLANT-NAME (CTR2).
054500  MOVE APROD-CODE (CTR2) TO ITEM-SYMBOL (CTR2).
054600  MOVE APLANT-CODE (CTR2) TO PLANT-SYMBOL (CTR2).
054700  MOVE AALTER-CODE (CTR2) TO IPM-CODE (CTR2).
054800  MOVE AUT-IPM-COSTS (CTR2) TO ONE-TIME-COST (CTR2).
054900  MOVE AA-IPM-COSTS (CTR2) TO ANNUAL-COST (CTR2).
055000  MOVE AIPM-DESC (CTR2) TO IPM-DESCRIPTION (CTR2).
055100  PRODUCT-SEARCH1.
055200  ADD 1 TO CTR1.
055300  IF APROD-CODE (CTR2) = PRODUCT-CODE (CTR1) MOVE
058600  MOVE ALLOC-FAC1 TO AF-PART1.
058700  MOVE ALLOC-FAC2 TO AF-PART2.
058800  MOVE AF-DUM TO PRODUCT-ALLOC-FACTOR (CTR1).
058900  EXAMINE PRO-FAC1 REPLACING ALL ' ' BY '0'.
059000  EXAMINE PRO-FAC2 REPLACING ALL ' ' BY '0'.
059100  MOVE PRO-FAC1 TO PF-PART1.
059200  MOVE PRO-FAC2 TO PF-PART2.
059300  MOVE PF-DUM TO PROCURE-FACTOR (CTR1).
059310  F-ROUT TAKES DATA FROM THE F-CARDS, ZERO FILLS THE NUMERIC
059320  FIELDS AND STORES THE DATA IN THE PLANT-TABLE.
059400  F-ROUT.
059500  ADD 1 TO CTR2.
059600  MOVE PROD-LINE TO APRD-LINE (CTR2).
059700  MOVE PROD-CODE TO APREDT-CODE (CTR2).
059800  MOVE PROD-CODE TO APRDDR-CODE (CTR2).
059900  MOVE ALTER-CODE TO AALTER-CODE (CTR2).
060000  MOVE PROD-SUPPORT TO APRDSUPPORT (CTR2).
060100  EXAMINE MAX-CAP1 REPLACING ALL ' ' BY '0'.
060200  MOVE MAX-CAP2 TO AMAX-CAP (CTR2).
060300  EXAMINE MSK1 REPLACING ALL ' ' BY '0'.
060400  MOVE MSR2 TO AMSR (CTR2).
060500  EXAMINE LINE-ALLOC-CODE1 REPLACING ALL ' ' BY '0'.
060600  MOVE LINE-ALLOC-CODE1 TO AF-PART1.
060700  EXAMINE LINE-ALLOC-CODE2 REPLACING ALL ' ' BY '0'.
060800  MOVE LINE-ALLOC-CODE2 TO AF-PART2.
060900  MOVE AF-DUM TO ALINE-ALLOC-CODE (CTR2).
061000  MOVE BASE-TEMP TO ABASE-TEMP (CTR2).
061010  G-ROUT ZERO FILLS NUMERIC FIELDS FROM THE G-CARD AND STORES
061020  DATA IN THE PLANT-TABLE.
061100  G-ROUT.
061200  EXAMINE DT-IPM-COSTS1 REPLACING ALL ' ' BY '0'.
061300  MOVE DT-IPM-COSTS2 TO ADT-IPM-COSTS (CTR2).
061400  EXAMINE A-IPM-COSTS1 REPLACING ALL ' ' BY '0'.
061500  MOVE A-IPM-COSTS2 TO AA-IPM-COSTS (CTR2).
061600  MOVE IPM-DESC TO AIPM-DESC (CTR2).
061610  BU-ROUT ZERO FILLS NUMERIC FIELDS FROM THE H1, H2, AND H3 CARDS.
061620* AND STORES DATA IN THE PLANT-TABLE.
061700 BU-ROUT.
061800 ADD 1 TO CTR3.
061900 IF CC-H1 = 'H1' MOVE PROD-BU-H1 (CTR1) TO
062000 ALPHA EXAMINE ALPHA REPLACING ALL "'" BY 'O' MOVE NUM TO
062100 ABUILD-UP (CTR2, CTR3).
062200 IF CC-H2 = 'H2' MOVE PROD-BU-H2 (CTR1) TO
062300 ALPHA EXAMINE ALPHA REPLACING ALL "'" BY 'O' MOVE NUM TO
062400 ABUILD-UP (CTR2, CTR3).
062500 IF CC-H3 = 'H3' MOVE PROD-BU-H3 (CTR1) TO
062600 ALPHA EXAMINE ALPHA REPLACING ALL "'" BY 'O' MOVE NUM TO
062700 ABUILD-UP (CTR2, CTR3).
062800 IF CTR3 = NO-OF-MONTHS MOVE 0 TO CTR3.
062900 GO TO BU-EXIT.
063000 BU-EXIT.
063100 EXIT.
063200 EOJ1.
063300 MOVE 0 TO CTR1.
063400 MOVE 0 TO CTR2.
063500 MOVE 0 TO CTR3.
063600 MOVE 'ON' TO SWITCH-A.
063700 CLOSE GLOSSARY-IN.
063800 OPEN INPUT DATA-IN.
063900 MOVE ZEROS TO ASSETS-ON-HAND-TABLE.
064000 MOVE ZEROS TO ASSETS-ON-HAND-TOTALS.
064100 MOVE ZEROS TO ASSETS-TO-BUY-TABLE.
064200 MOVE ZEROS TO ASSETS-TO-BUY-TOTALS.
064300 MOVE ZEROS TO PROD-UTIL-TABLE-ZERO.
064400 MOVE ZEROS TO UTIL-TOTALS-TABLE.
064500 MOVE ZEROS TO PROD-TOTALS-TABLE.
064600 MOVE ZEROS TO SUMMARY-GRAND-TOTALS.
064700 MOVE ZEROS TO SUMMARY-REQUIREMENTS.
064800 DATA-READ.
064900 READ DATA-IN AT END GO TO EOJ2.
065000 IF START-FILE = 'SECTION 1 - ROWS' MOVE 'OFF' TO
065100 SWITCH-B GO TO DATA-READ.
065200 IF SWITCH-B = 'ON' GO TO DATA-READ.
065210* THE FOLLOWING 'IF' CLAUSE LOCATES THE COST ASSOCIATED WITH
065220* THE IA/PT RUN BEING REPORTED AND STORES THE COST IN THE
065230* COST-CHECK FIELD FOR LATER REFERENCE.
065300 IF IXY-CODE = 'C' AND PLANT-CODE = 'OST'
065400 PERFORM DECIMAL-LOCATE THRU DECIMAL-LOCATE-END
065500 MOVE ACTIVITY TO COST-CHECK.
065600 IF START-FILE = 'SECTION 2 - COLUMNS' MOVE 'OFF' TO
065700 OFF-GO TO DATA-READ.
065800 IF SWITCH-D = 'ON' GO TO DATA-READ.
065900 IF IXY-CODE = 'X' GO TO PROD-UTIL-ROUT.
066000 IF (IXY-CODE = 'Y' OR IXY-CODE = 'H') AND INV-CODE IS NOT
066100 EQUAL TO PREV-INV-CODE MOVE SPACES TO PREV-ITEM.
066200 IF IXY-CODE = 'Y' OR IXY-CODE = 'H' NEXT SENTENCE ELSE GO
066300 TO DATA-READ.
066310* INV-ROUT THRU JUMP ACCUMULATES ASSETS-ON-HAND AND ASSETS-TO-BUY
066320* AND STORES THEM IN TABLES.
066400 INV-ROUT.
066500 PERFORM DECIMAL-LOCATE THRU DECIMAL-LOCATE-END.
066600 IF DEC-COUNT = 1 AND ZERU-COUNT = 12 GO TO DATA-READ.
066700 IF DEC-COUNT = 0 AND ZERO-COUNT = 13 GO TO DATA-READ.
066800 IF ITEM-CODE = PREV-ITEM GO TO JUMP.
066900 IF INV-CODE = '2' ADD 1 TO ITEM-CTR2 MOVE ITEM-CODE TO
067000 ITEM2 (ITEM-CTR2) ELSE ADD 1 TO ITEM-CTR1 MOVE
067100 ITEM-CODE TO ITEM1 (ITEM-CTR1).
067200 PERFORM ITEM-TABLE-SEARCH-Y THRU END-SEARCH-Y.
067300 JUMP.
067400 MOVE INV-CODE TO PREV-INV-CODE.
067500 SUBTRACT 10 FROM MONTH-USE GIVING MONTH-USE.
067600 IF MONTH-USE = 0 OR MONTH-USE < 0 MOVE 1 TO MONTH-USE.
067700 IF INV-CODE = '2' AND ITEM- нарушен BY PRODUCT (1) AND MONTH-USE =
067800 '11' AND ACT-SIGN = '-' SUBTRACT ACTIVITY FROM O GIVING
067900 ACTIVITY.
068000 IF INV-CODE = '2' ADD ACTIVITY TO
068100 QTY-ON-HAND (ITEM-CTR2, MONTH-USE) ROUNDED
068200 ADD ACTIVITY TO TOTAL-ASSETS-ON-HAND (ITEM-CTR2) ROUNDED
068300 ELSE
068400 ADD ACTIVITY TO QTY (ITEM-CTR1, MONTH-USE) ROUNDED
068500 ADD ACTIVITY TO TOTAL-ASSETS-TO-BUY (ITEM-CTR1) ROUNDED.
068600 MOVE ITEM-CODE TO PREV-ITEM.
068700 GO TO DATA-READ.
068710* THE PROD-UTIL-ROUT PARAGRAPH ACCUMULATES THE MONTHLY PRODUCT-
068720* ION AND THE MONTHLY UTILIZATION BY PLANT AND STORES THE DATA
068730* IN TABLES.
068800 PROD-UTIL-ROUT.
068900 PERFORM DECIMAL-LOCATE THRU DECIMAL-LOCATE-END.
069000 IF DEC-COUNT = 1 AND ZERO-COUNT = 12 GO TO DATA-READ.
069100 IF DEC-COUNT = 0 AND ZERO-COUNT = 13 GO TO DATA-READ.
069200 IF PLANT-CODE IS NOT EQUAL TO PREV-PLANT ADD 1 TO PLANT-CTR
069300 MOVE PLANT-CODE TO PLANT (PLANT-CTR).
069400 PERFORM ITEM-TABLE-SEARCH-X THRU END-SEARCH-X.
069500 SUBTRACT 10 FROM PROD-MONTH GIVING PROD-MONTH.
069600 SUBTRACT 10 FROM UTIL-MONTH GIVING UTIL-MONTH.
069700 ADD ACTIVITY TO ELEM (PLANT-CTR, PROD-MONTH, 1) ROUNDED.
069800 ADD ACTIVITY TO ELEM (PLANT-CTR, UTIL-MONTH, 2) ROUNDED.
069900 ADD ACTIVITY TO TOTAL-UTIL (PLANT-CTR) ROUNDED.
070000 ADD ACTIVITY TO TOTAL-PROD (PLANT-CTR) ROUNDED.
070100 MOVE PLANT-CODE TO PREV-PLANT.
070200 GO TO DATA-READ.
070300 ITEM-TABLE-SEARCH-Y.
070400 MOVE ZERO TO CTR3.
070410* ITEM-TABLE-ADD-Y STORES THE CODES FOR ITEMS REPRESENTED BY THE
070420* 'Y' VARIABLES IN THE ITEM-TABLE.
070500 ITEM-TABLE-ADD-Y.
070600 IF ITEM-CTR = 0 ADD 1 TO ITEM-CTR MOVE ITEM-CODE TO
070700 ITEM (ITEM-CTR) GO TO END-SEARCH-Y.
070800 ADD 1 TO CTR3.
070900 IF ITEM-CODE = ITEM (CTR3) GO TO END-SEARCH-Y.
071000 IF CTR3 = ITEM-CTR ADD 1 TO ITEM-CTR MOVE ITEM-CODE TO
071100 ITEM (ITEM-CTR) GO TO END-SEARCH-Y.
071200 GO TO ITEM-TABLE-ADD-Y.
071300 END-SEARCH-Y.
071400  EXIT.
071410* ITEM-TABLE-SEARCH-X STORES THE CODES FOR ITEMS REPRESENTED BY
071420* THE X VARIABLES IN THE ITEM-TABLE.
071500 ITEM-TABLE-SEARCH-X.
071600  MOVE ZER0 TO CTR3.
071700 ITEM-TABLE-ADD-X.
071800  IF ITEM-CTR = 0 ADD 1 TO ITEM-CTR MOVE
071900     ITEM-MADE TO ITEM (ITEM-CTR) GO TO END-SEARCH-X.
072000  ADD 1 TO CTR3.
072100  IF ITEM-MADE = ITEM (CTR3) GO TO END-SEARCH-X.
072200  IF CTR3 = ITEM-CTR ADD 1 TO ITEM-CTR MOVE ITEM-MADE TO
072300     ITEM (ITEM-CTR) GO TO END-SEARCH-X.
072400  GO TO ITEM-TABLE-ADD-X.
072500  END-SEARCH-X.
072600  EXIT.
072700  ENJ2.
072800  MOVE PLANT-CTR TO NO-OF-PLANTS.
072900  MOVE ZER0 TO ITEM-CTR.
073000  MOVE ZER0 TO PLANT-CTR.
073100  MOVE ITEM-CTR1 TO NO-OF-ITEMS1.
073200  MOVE ITEM-CTR2 TO NO-OF-ITEMS2.
073300  MOVE ZER0 TO ITEM-CTR1.
073400  MOVE ZER0 TO ITEM-CTR2.
073500  MOVE ZER0 TO CTR3.
073600  MOVE 0 TO GLOSSARY-CTR.
073610* LOOP1 STARTS THE COMPLETION OF THE ITEM-COST-TABLE.
073700  LOOP1.
073800  ADD 1 TO ITEM-CTR1.
073900  MOVE ZER0 TO GLOSSARY-CTR.
074000  LOOP2.
074100  ADD 1 TO GLOSSARY-CTR.
074200  IF GLOSSARY-CTR IS GREATER THAN GLOSSARY-MAX GO TO
074300     ERROR-MSG4.
074400  IF ITEM1 (ITEM-CTR1) IS NOT EQUAL TO
074500     ITEM-SYMBOL (GLOSSARY-CTR) GO TO LOOP2.
074600  MOVE ITEM-UNIT-COST (GLOSSARY-CTR) TO
074700 A-ITEM-CUST (ITEM-CTR).
074800 MOVE ITEM-NAME (GLOSSARY-CTR) TO
074900 A-ITEM-NAME (ITEM-CTR).
075000 MOVE TOTAL-ASSETS-TO-BUY (ITEM-CTR) TO
075100 A-ITEM-ASSETS (ITEM-CTR).
075200 IF ITEM-CTR1 = NO-OF-ITEMS1 GO TO LOOP5 ELSE GO TO LOOP1.
075210 THE PRINT OF THE REPORT STARTS WITH LOOP 5.
075300 LOOP5.
075400 MOVE SPACES TO IA-PT-BUY-LINE.
075500 MOVE ITEM-NAME (1) TO IA-PT-ITEM.
075600 WRITE PRINT-OUT FROM PAGE-HEADING AFTER ADVANCING NEXT-PAGE.
075700 WRITE PRINT-OUT FROM IA-PT-BUY-HD1 AFTER ADVANCING 1 LINES.
075800 WRITE PRINT-OUT FROM IA-PT-BUY-HD2 AFTER ADVANCING 2 LINES.
075900 LOOP6.
076000 ADD 1 TO SUB1.
076100 MOVE A-ITEM-NAME (SUB1) TO IA-PT-NAME.
076200 MOVE A-ITEM-COST (SUB1) TO IA-PT-COST.
076300 MOVE A-ITEM-ASSETS (SUB1) TO IA-PT-BUY.
076400 COMPUTE TOTAL-ITEM-COST ROUNDED = A-ITEM-COST (SUB1) * 0.0001
076500 A-ITEM-ASSETS (SUB1) ON SIZE ERROR GO TO ERROR-MSG2.
076600 ADD TOTAL-ITEM-COST TO TOTAL-PLAN-COST.
076700 MOVE TOTAL-ITEM-COST TO TOTAL-IA-PT-ITEM-COST.
076800 WRITE PRINT-OUT FROM IA-PT-BUY-LINE AFTER ADVANCING 2 LINES.
076900 IF SUB1 IS NOT EQUAL TO NO-OF-ITEMS1 GO TO LOOP6 ELSE MOVE
077000 TOTAL-PLAN-COST TO IA-PT-TOTAL-COST-OUT WRITE PRINT-OUT
077100 FROM IA-PT-TOTAL-PLAN-COST AFTER ADVANCING 3 LINES
077200 MOVE 0 TO SUB1.
077300 MOVE ITEM-NAME (1) TO IPM-HD1-ITEM.
077400 MOVE SPACES TO PRINT-OUT.
077500 WRITE PRINT-OUT AFTER ADVANCING 3 LINES.
077600 WRITE PRINT-OUT FROM IPM-HD1 AFTER ADVANCING 3 LINES.
077700 WRITE PRINT-OUT FROM IPM-HD4 AFTER ADVANCING 2 LINES.
077800 MOVE 0 TO PLANT-CTR.
077900 PERFORM IPM-SEARCH THRU IPM-EXIT VARYING
078000 PLANT-CTR FROM 1 BY 1 UNTIL PLANT-CTR IS GREATER THAN
078100 NO-OF-PLANTS.
078200  MOVE IPM-TOTAL-COST TO IPM-AMT.
078300  WRITE PRINT-OUT FROM IPM-COST-LINE AFTER ADVANCING 3 LINES.
078400  ADD TOTAL-PLAN-COST, IPM-TOTAL-COST GIVING GRAND-TOTAL.
078500  MOVE GRAND-TOTAL TO GRAND-AMT.
078600  WRITE PRINT-OUT FROM GRAND-TOTAL-LINE AFTER ADVANCING
078700  3 LINES.
078800  IF (GRAND-TOTAL - COST-CHECK > 0 AND GRAND-TOTAL - COST-CHECK
078900  < 10) OR (GRAND-TOTAL - COST-CHECK < 0 AND GRAND-TOTAL -
079000  COST-CHECK > -10) NEXT SENTENCE ELSE WRITE PRINT-OUT FROM
079100  ERR-MESS3 AFTER ADVANCING 3 LINES.
079200  CLOSE DATA-IN, OUTPUT-FILE.
079300  STOP RUN.
079310  IPM-SEARCH MOVES INFO FROM THE GLOSSARY-TABLE TO PRINT LINE.
079400  IPM-SEARCH.
079500  MOVE SPACES TO IPM-LINE.
079600  MOVE SPACES TO IPM-LINE2.
079700  MOVE ZERO TO GLOSSARY-CTR.
079800  IPM-GLSS-SEARCH.
079900  IF GLOSSARY-CTR = GLOSSARY-MAX GO TO ERROR-MSG1.
080000  ADD 1 TO GLOSSARY-CTR.
080100  IF PLANT (PLANT-CTR) = PLANT-SYMBOL (GLOSSARY-CTR) NEXT
080200  SENTENCE ELSE GO TO IPM-GLSS-SEARCH.
080300  IF IPM-CODE (GLOSSARY-CTR) = 1 GO TO IPM-EXIT.
080400  MOVE PLANT-NAME1 (GLOSSARY-CTR) TO PLANT-T.
080500  MOVE PLANT-NAME2 (GLOSSARY-CTR) TO PLANT-T2.
080600  MOVE ITEM-NAME1 (GLOSSARY-CTR) TO PRODUCT-T.
080700  MOVE ITEM-NAME2 (GLOSSARY-CTR) TO PRODUCT-T2.
080800  MOVE ONE-TIME-COST (GLOSSARY-CTR) TO OTC.
080900  MOVE ANNUAL-COST (GLOSSARY-CTR) TO AC.
081000  COMPUTE IPM-COST = ONE-TIME-COST (GLOSSARY-CTR) +
081100  5 * ANNUAL-COST (GLOSSARY-CTR) ON SIZE ERROR GO TO
081200  ERROR-MSG2.
081300  COMPUTE IPM-TOTAL-COST = IPM-TOTAL-COST + IPM-COST ON SIZE
081400  ERROR GO TO ERROR-MSG2.
081500  MOVE IPM-AMT TO IPM-TC.
081600  MOVE IPM-DESCRIPTION1 (GLOSSARY-CTR) TO IPM-NOTE1.
081700 MOVE IPM-DESCRIPTION2 (GLOSSARY-CTR) TO IPM-NOTE2.
081800 WRITE PRINT-OUT FROM IPM-LINE AFTER ADVANCING 2 LINES.
081900 WRITE PRINT-OUT FROM IPM-LINE2 AFTER ADVANCING 1 LINES.
082000 MOVE SPACES TO IPM-LINE.
082100 MOVE SPACES TO IPM-LINE2.
082200 IPM-EXIT.
082300 EXIT.
082310* THE FOLLOWING PARA NUMBERS THE TABLES.
082400 TABLE-NO-ROUT.
082500 ADD 1 TO TABLE-CTR.
082600 MOVE TABLE-CTR TO TABLE-NO.
082700 WRITE PRINT-OUT FROM TABLE-NUMBER-LINE AFTER ADVANCING
082800 3 LINES.
082810* DECIMAL-LOCATE THRU DECIMAL-LOCATE-END LOCATES A VARIABLE
082820* DECIMAL POINT WITHIN A FIELD.
082900 DECIMAL-LOCATE.
083000 EXAMINE INPUT-REC REPLACING ALL '' BY '0'.
083100 EXAMINE INPUT-REC TALLYING ALL ''.
083200 MOVE TALLY TO DEC-COUNT.
083300 EXAMINE INPUT-REC TALLYING ALL '0'.
083400 MOVE TALLY TO ZERO-COUNT.
083500 IF DEC-COUNT = 1 AND ZERO-COUNT = 12 GO TO
083600 DECIMAL-LOCATE-END.
083700 IF DEC-COUNT = 0 AND ZERO-COUNT = 13 GO TO
083800 DECIMAL-LOCATE-END.
083900 EXAMINE INPUT-REC TALLYING UNTIL FIRST ''. 
084000 DECIMAL1.
084100 ADD 1 TO SUB4.
084200 DECIMAL2.
084300 ADD 1 TO SUB5.
084400 ADD SUB5, 6 GIVING DEC-Chk.
084500 IF DEC-Chk = TALLY AND TALLY < 13 GO TO DECIMAL2.
084600 MOVE ACT (SUB5) TO ACT-NO (SUB4).
084700 IF SUB4 < 5 GO TO DECIMAL1.
084800 IF SUB4 = 5 AND TALLY < 13 MOVE 0 TO ACT-NO (6)
084900 GO TO DECIMAL3.
085000 IF SUB4 = 5 AND TALLY = 13 MOVE ACT (6) TO ACT-NO (6).
085100 DECIMAL3.
085200 MOVE ACT-INT TO ACT-INT-NO.
085300 IF TALLY = 7 MOVE ACTIVITY1 TO ACTIVITY.
085400 IF TALLY = 8 MOVE ACTIVITY2 TO ACTIVITY.
085500 IF TALLY = 9 MOVE ACTIVITY3 TO ACTIVITY.
085600 IF TALLY = 10 MOVE ACTIVITY4 TO ACTIVITY.
085700 IF TALLY = 11 MOVE ACTIVITY5 TO ACTIVITY.
085800 IF TALLY = 12 MOVE ACTIVITY6 TO ACTIVITY.
085900 IF TALLY = 13 MOVE ACTIVITY7 TO ACTIVITY.
086000 MOVE 0 TO SUB4.
086100 MOVE 0 TO SUB5.
086200 MOVE 0 TO DEC-CHK.
086300 DECIMAL-LOCATE-END.
086400 EXIT.
086500 ITEM-1-WRITE.
086600 MOVE ITEM1 (CTR3) TO ITEM1-OUT.
086700 WRITE PRINT-OUT FROM ITEM1-CHECK AFTER ADVANCING 2 LINES.
086800 GLOSSARY-WRITE.
086900 MOVE GLIST (GLOSSARY-CTR) TO GLOSS-OUT.
087000 WRITE PRINT-OUT FROM GLOSSARY-CHECK AFTER ADVANCING 2 LINES.
087010* ERROR-MSG1 INDICATES AN ERROR IN PRODUCT-SEARCH1.
087100 ERROR-MSG1.
087200 WRITE PRINT-OUT FROM ERR-MESS1 AFTER ADVANCING 2 LINES.
087300 STOP RUN.
087310* ERROR-MSG2 INDICATES THE RECEIVING FIELD IS TOO SMALL.
087400 ERROR-MSG2.
087500 WRITE PRINT-OUT FROM ERR-MESS2 AFTER ADVANCING 2 LINES.
087600 STOP RUN.
087610* ERROR-MSG4 INDICATES AN ERROR IN LOOP2.
087700 ERROR-MSG4.
087800 WRITE PRINT-OUT FROM ERR-MESS4 AFTER ADVANCING 2 LINES.
087900 STOP RUN.

7. THE FIRST SET OF JCL IS USED TO INITIATE A PROBLEM BY
GENERATING A MATRIX AND STARTING INTO THE SOLUTION PROCESS:

//IAPTIB PROC
//MPSEXEC EXEC PGM=DJEXEC,REGION=300K,PARM=TASK,DPRTY=(13,13),
// TIME=150
//STEPLIB DD DSN=MAMT.IAPT.LOAD,DISP=SHR
//SCRATCH1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//SCRATCH2 DD UNIT=(ITEL,SEP=SCRATCH1),SPACE=(CYL,(10),,CONTIG)
//PROFILE DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA2 DD UNIT=(ITEL,SEP=ETA1),SPACE=(CYL,(10),,CONTIG)
//MATRIX1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//MATRIX2 DD UNIT=(ITEL,SEP=MATRIX1),SPACE=(CYL,(10),,CONTIG)
//MIXWORK DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//F05F001 DD DDNAME=SYSIN
//F06F001 DD SYSOUT=A
//F08F001 DD UNIT=ITEL,SPACE=(CYL,(10,10))
//SYSMLCP DD DSN=MAMT.MLCPF.LOAD(START),DISP=SHR
//SYSPRINT DD SYSOUT=A
//SYSPLUNCH DD SYSOUT=B

8. THE SECOND SET OF JCL IS USED TO RESUME A PROBLEM THAT HAS NOT FOUND A CONTINUOUS OPTIMAL SOLUTION BY RESTORING AND PROCEEDING WITH THE SOLUTION PROCESS:

//IAPT2B PROC
//MPSEXEC EXEC PGM=DJEXEC,REGION=300K,PARM=TASK,DPRTY=(13,13),
// TIME=150
//STEPLIB DD DSN=MAMT.IAPT.LOAD,DISP=SHR
//SCRATCH1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
9. The third set of JCL is used to resume a problem that has
found a continuous optimum but not an integer optimum by
restoring and proceeding with the solution process.
10. THE FOURTH SET OF JCL IS USED TO EXTRACT A SOLUTION AND
GENERATE A REPORT.

//IAPT4B PROC
//MPSEXEC EXEC PGM=DJLEXEC,REGION=300K,PARM=Task,DPRTY=(13,13),
//TIME=150
//SCRATCH1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//STEPLIB DD DSN=MART.IMART.LOAD,DISP=SHR
//SCRATCH2 DD UNIT=(ITEL,SEP=SCRATCH1),SPACE=(CYL,(10),,CONTIG)
//PROBFILE DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//ETA2 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//MATRIX1 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//MATRIX2 DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//MIXWORK DD UNIT=ITEL,SPACE=(CYL,(10),,CONTIG)
//FT05F001 DD DSN=SYSIN
//FT06F001 DD SYSSOUT=A
//FT08F001 DD UNIT=ITEL,SPACE=(CYL,(10,10))
//SYSHLCP DD DSN=MART.MLCPF.LOAD(INSRT),DISP=SHR
//SYSPRT DD SYSPRT=A
//SYSPUNCH DD DUMMY

11. THE FOLLOWING FORTRAN SUBROUTINE CHECKS THE DAYS OF THE WEEK
AND THE TIME OF DAY THE JOB STARTS. IF IT IS BETWEEN 0700 AND
1600 ON MONDAY THROUGH FRIDAY IT WILL SET XDELMAT AT 9 MIN,
OTHERWISE IT WILL SET XDELMAT AT 60 MIN. THE VALUE OF XDELMAT
DETERMINES AT WHAT TIME THE SOLUTION WILL BE SAVED.

INTEGER*2 HOL(15), DAREA(19)
DATA HOL/2H70, 2H71, 2H72, 2HSA, 2HSU, 2M00, 2M10, 2M20, 2M30,
1 2M40, 2M50, 2M60, 2H70, 2H80, 2H90/
CALL AS9ADD(DAREA)
M=9
IF(DAREA(18).EQ.HOL(4)) GO TO 10
IF(DAREA(18).EQ.HOL(5)) GO TO 10
DO 3 N=1,3
3 IF (DAREA(14).EQ. HOL(N)) J=N-1
DO 5 N=6,15
5 IF(DAREA(15).GE. HOL(N)) K=N-6
I=10+J+K
IF(I.LT.7) GO TO 10
IF(I.GE.16) GO TO 10
GO TO 15
M=120
15 CALL PUTFAR(M)
RETURN
END
APPENDIX B

COMPARATIVE RUNNING TIME
COMPARATIVE RUNNING TIME

The IA/PT model may require a large amount of CPU time for items with many components and IPMs. Table B-1 relates problem size to run time. This table is provided to assist in estimating time to solution. The most significant variable that affects running time is the size of the problem as measured by the number of alternative solutions. The run time estimate is made as follows:

(1) List the number of alternatives put in for each line (including the current capability).

(2) Sum these alternatives and compare with the first column (number of alternatives) in the table.

(3) Multiply the numbers of alternatives for each line and compare them with the second column (alternative solutions).

(4) The third and fourth columns give observed run times for Modes 1 and 2, respectively. These numbers should not be used as absolutes but as general guidelines. The fourth item of the fourth column (3.3 min) is for a solution for RR=0.0; if there were assets, run time would be expected to be considerably longer. Table B-2 provides further information about the mixed integer problems for which the run times are shown.
<table>
<thead>
<tr>
<th>No. of Alternatives</th>
<th>Alternative Solutions</th>
<th>CP Run Time (Min)</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>Mode 1</td>
</tr>
<tr>
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<td>8</td>
<td>19.3</td>
</tr>
<tr>
<td>21</td>
<td>256</td>
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<td>4096</td>
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<tr>
<td>43</td>
<td>139968</td>
<td>534.4</td>
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<td>Rows</td>
<td>Columns</td>
</tr>
<tr>
<td>------------------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>81mm M374A2</td>
<td>521</td>
<td>3802</td>
</tr>
<tr>
<td>CBU-58B FY77</td>
<td>502</td>
<td>3304</td>
</tr>
<tr>
<td>CBU-58B FY76</td>
<td>596</td>
<td>3342</td>
</tr>
<tr>
<td>105mm HE, M1</td>
<td>818</td>
<td>6945</td>
</tr>
<tr>
<td>155mm M07</td>
<td>945</td>
<td>7664</td>
</tr>
<tr>
<td>MK82 Bomb</td>
<td>1104</td>
<td>9563</td>
</tr>
</tbody>
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