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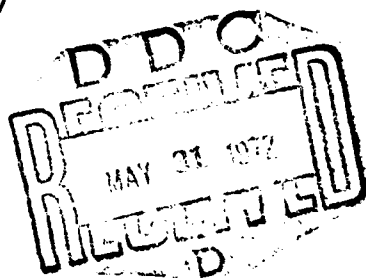
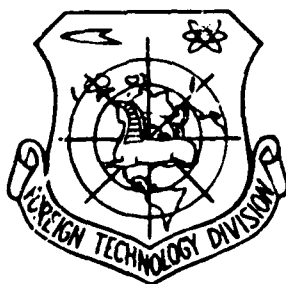
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USE OF OFFICE COMPUTERS FOR PLANNING STUDIES

by

F. O. Mangiurea

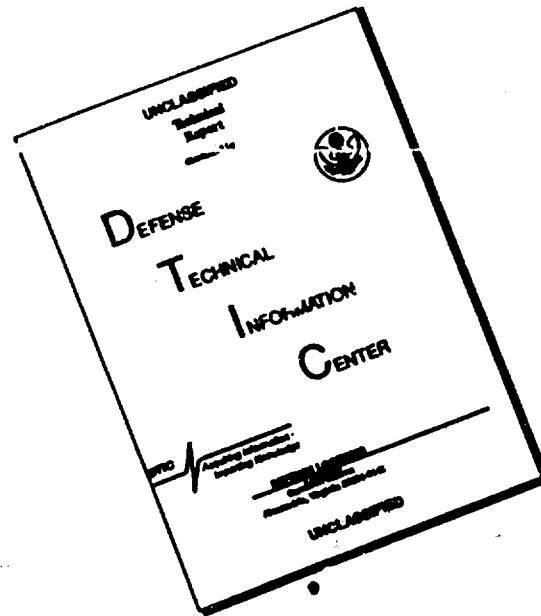


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13. ABSTRACT <p>A rational use of computers is required to make them available to domestic units which handle data automatically. Many problems which do not require the use of a large computer are encountered in design and planning work. Small office computers provided with small memories and programmed in a language close to machine language allow to solve pertinent problems and to save considerable amounts of time. Several Romanian personnel have been provided with the programs for office computer which has a memory with a capacity of 2048 bits in addition to the period and algebraic signs. The memory consists of a magnetostriictively operated line; stopping of the machine removes all information from it. This computer may be conveniently used for administrative and planning studies, illustrated by the programming and calculation of three types of tables are indicated. The experience gained indicates that an 8 to 10-fold time saving may be obtained with respect to mechanical calculators. (See part. num: 1 table, 2 lines.</p>			

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Memory Core Information Storage and Retrieval Computer Language Natural Language						

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USE OF OFFICE COMPUTERS FOR PLANNING STUDIES

/Article by Engr. F.O. Mangiurea; Bucharest, Automatica si Electronica, Romanian, Vol. 14, No. 2, February 1970, pp 92-967

Efficient use of electronic computers calls for providing those economic units engaged in automatic data processing with various types of computers, beginning with office computers and all the way on up to those having large-capacity internal and external memories justified by the volume of frequency of data processing work carried on.

A number of lesser problems encountered in calculations for design work, administrative purposes and planning cannot be efficiently solved by a large computer since it would not be suitable to use it for such purposes and smaller computers are available, while larger ones are seldom unoccupied.

Office computers with small memory units and programmed in a language near that of machine language often make it possible to effectively solve some interesting problems which would take about ten hours more using conventional mechanical calculators.

A number of institutions in our country have been provided with Programma 101 office computers which have also been used for the programs exemplified in this paper.

The memory of the Programma 101 computer is made up of five numerical registers having a capacity of 22 digits in addition to the decimal point and algebraic sign, it being possible to divide each register in two parts (split). In addition, three operational registers are available (M, A and R) that operate directly in carrying out mathematical operations. A typical program contains 48 instructions. When no numerical data is memorized in registers D, E and F, a program may attain a maximum of 120 instructions.

The memory consists physically of a magnetostrictively actuated line, reading and print-out circuits associated with this line and memory regeneration circuits. The operation of the machine conducts the information data into the memory mechanism.

The output devices of this type of computer are: a printer typing out 28 columns at a speed of 30 characters per second and a magnetic card recording device upon which one can record its program or a string of data from the computer memory. There is therefore the possibility of setting up a "library" of computer programs recorded on the magnetic cards. Input devices are represented by the keyboard and the magnetic cards.

Examples of tables worked out aided by an office computer

In general, office computer program libraries contain mathematical programs to compute logarithms, certain trigonometric functions, exponential functions, determinants, programs used in physics, mechanics, electrical and electronic engineering and statistics, and for administrative computations for various types of invoices, percentages, average prices, and so on.

These computers can be used in administrative and planning work to calculate certain tables and printed forms used by central authorities, applications seldom encountered in the program libraries supplied by manufacturers.

The smaller the amount of data fed in at the input and the greater the number of calculations carried out, the better the efficiency of operation of these computers (because input data are fed in manually by the keyboard operator).

A simple table, the program for which has been recorded on a single magnetic card for the Programma 101 office computer, is that of totaling five columns horizontally and n columns vertically, used to sum up the values of n products broken down by individual years in a five-year plan period.

The input data for the table are:

$$\begin{array}{ll} a_{11} & a_{12} \dots a_{1j} \\ a_{21} & a_{22} \dots a_{2j} \\ \vdots & \\ a_{n1} & a_{n2} \dots a_{nj} \end{array}$$

The data calculated:

a. For each line are:

$$\sum_{j=1}^b a_{1j}, \sum_{j=1}^b a_{2j}, \sum_{j=1}^b a_{3j}, \dots, \sum_{j=1}^b a_{ij};$$

b. For each column:

$$\sum_{i=1}^n a_{i1}, \sum_{i=1}^n a_{i2}, \sum_{i=1}^n a_{i3}, \dots, \sum_{i=1}^n a_{ib}.$$

The final data calculated:

$$\sum_{i=1}^n \frac{\sum_{j=1}^b a_{ij}}{\sum_{j=1}^b \sum_{i=1}^n a_{ij}} \cdot 100, \\ \frac{\sum_{i=1}^n a_{i2}}{\sum_{i=1}^n \sum_{j=1}^b a_{ij}} \cdot 100, \dots, \frac{\sum_{i=1}^n a_{ib}}{\sum_{i=1}^n \sum_{j=1}^b a_{ij}} \cdot 100.$$

The logic diagram of the computation and the program is shown in Figure 1.

By following the program carried out as shown in this table one can see how the computer is put to use.

After the magnetic card is fed into the computer (here shown in Figure 1 as the program), we address the program. The five figures are addressed that represent the values of a product for five plan years, after which the sums are posted horizontally, with the computer returning to program AV.

After going through n products, key Y is depressed (program AY), calculating the sums vertically as well as the other required data.

On addressing program AV again at the end of the computation, the computer returns automatically to its original position, with the program beginning by automatically erasing the content of registers B, C, D, and e so that work performed with the computer can proceed without having to operate the general clear control and reinsert the magnetic card.

One example of a more complex table computed using a Programma 101 is computation of the effects on the budget of import and export trade, shown below.

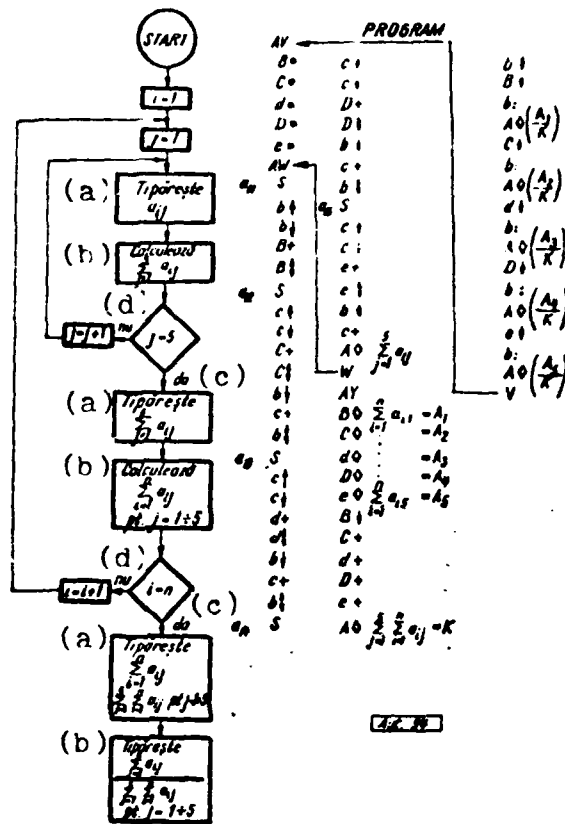


Figure 1. Logic diagram of computation and program of totaled table.

Key:
 (a) Write-in (c) Yes
 (b) Compute (d) No

Input data:

For each product values are given:

- a_{ijk} - quantity of products
- b_{ijk} - value per unit measure in lei valuta
- c_{ijk} - value per unit measure in lei

wherein:

i represents the relation East, West I and West II.

j represents the n products of a ministry.

k represents the m ministries.

The data computed are specified in Table 1.

Figure 2 shows the typical diagram used to compute the values specified in Table 1.

The computer program had to be recorded on four different magnetic cards with all iterations repeated within the framework of the same program (for $i = 1...3$, $j = 1...n$ and $k = 1...m$). The third card actually utilized supporting data for the final portion of the computations.

Computation of the effect on the budget is characterized by the large number of operations carried out, including a number of subtotals by relations, products, ministries and the national economy as a whole.

Another type of table has an increased amount of input data (compared with the three input data in the table mentioned in the previous example) and a greater number of totals and sub-totals. Due to the limited size of the memory in the office computer these computations must be carried out in a series of two, three or more program steps.

In order to simplify the computations and eliminate possibilities of error, overlays have been prepared to cover the table, leaving free only those columns within which the results are to be inserted.

Figure 3 shows a table of the type previously described. The input data is represented by the figures entered in columns 1-9, respectively:

wherein:

$j = 1, \dots, m$ is the number of branches under a ministry.

$i = 1, \dots, n$ is the number of ministries

$k = 1, \dots, 9$ is the number of columns.

For each horizontal line one calculates:

$$Y_{010} = \frac{Y_{04}}{Y_{01}} \cdot 100 \text{ (column 10 in percent)}$$

$$Y_{011} = \frac{Y_{05}}{Y_{03}} \cdot 100 \text{ (column 11 in percent).}$$

Table 1 - Data used in computing effects of import trade on the budget.

	(1) Valoarea, in lei valuta	(2) Valoarea, in lei	(3) Diferența de valoare	(4) Cursul de schimb
0	1	2	3	4
A. Pentru fiecare relație (E, VI, VII) a unui produs	$a_{ijk} b_{ijk}$	$a_{ijk} c_{ijk}$	$a_{ijk} c_{ijk} - a_{ijk} b_{ijk}$	$\frac{a_{ijk} c_{ijk}}{a_{ijk} b_{ijk}}$
B. Pentru fiecare produs și toate relațiile	$\sum_{i=1}^3 a_{ijk} b_{ijk}$	$\sum_{i=1}^3 a_{ijk} c_{ijk}$	$\sum_{i=1}^3 a_{ijk} c_{ijk} - a_{ijk} b_{ijk}$	$\frac{\sum_{i=1}^3 a_{ijk} c_{ijk}}{\sum_{i=1}^3 a_{ijk} b_{ijk}}$
C. Pentru un minister pe fiecare relație	$\sum_{j=1}^n a_{ijk} b_{ijk}$ for $i = 1, 2, 3$	$\sum_{j=1}^n a_{ijk} c_{ijk}$ for $i = 1, 2, 3$	$\sum_{j=1}^n a_{ijk} c_{ijk} - a_{ijk} b_{ijk}$ for $i = 1, 2, 3$	$\frac{\sum_{j=1}^n a_{ijk} c_{ijk}}{\sum_{j=1}^n a_{ijk} b_{ijk}}$
D. Pentru n produse, un minister pe toate relațiile	$\sum_{i=1}^3 \sum_{j=1}^n a_{ijk} b_{ijk}$	$\sum_{i=1}^3 \sum_{j=1}^n a_{ijk} c_{ijk}$	$\sum_{i=1}^3 \sum_{j=1}^n a_{ijk} c_{ijk} - a_{ijk} b_{ijk}$	$\frac{\sum_{i=1}^3 \sum_{j=1}^n a_{ijk} c_{ijk}}{\sum_{i=1}^3 \sum_{j=1}^n a_{ijk} b_{ijk}}$
E. Pentru m ministere pe fiecare relație	$\sum_{i=1}^n \sum_{k=1}^m a_{ijk} b_{ijk}$ for $i = 1, 2, 3$	$\sum_{i=1}^n \sum_{k=1}^m a_{ijk} c_{ijk}$ for $i = 1, 2, 3$	$\sum_{i=1}^n \sum_{k=1}^m a_{ijk} c_{ijk} - a_{ijk} b_{ijk}$ for $i = 1, 2, 3$	$\frac{\sum_{i=1}^n \sum_{k=1}^m a_{ijk} c_{ijk}}{\sum_{i=1}^n \sum_{k=1}^m a_{ijk} b_{ijk}}$
F. Pe economie, pentru m ministere și toate relațiile	$\sum_{i=1}^3 \sum_{j=1}^n \sum_{k=1}^m a_{ijk} b_{ijk}$	$\sum_{i=1}^3 \sum_{j=1}^n \sum_{k=1}^m a_{ijk} c_{ijk}$	$\sum_{i=1}^3 \sum_{j=1}^n \sum_{k=1}^m a_{ijk} c_{ijk} - a_{ijk} b_{ijk}$	$\frac{\sum_{i=1}^3 \sum_{j=1}^n \sum_{k=1}^m a_{ijk} c_{ijk}}{\sum_{i=1}^3 \sum_{j=1}^n \sum_{k=1}^m a_{ijk} b_{ijk}}$

Key:

1. Value in lei valuta.
2. Value in lei.
3. Difference in value.
4. Rate of exchange.
- A. For each relation (E, VI, VII) of a product.
- B. For each product and all relations.
- C. For one minister for each relation.
- D. For n products, one minister for all relations.
- E. For m ministries for each relation.
- F. For the national economy, for m ministries and all relations. See footnote on next page7.

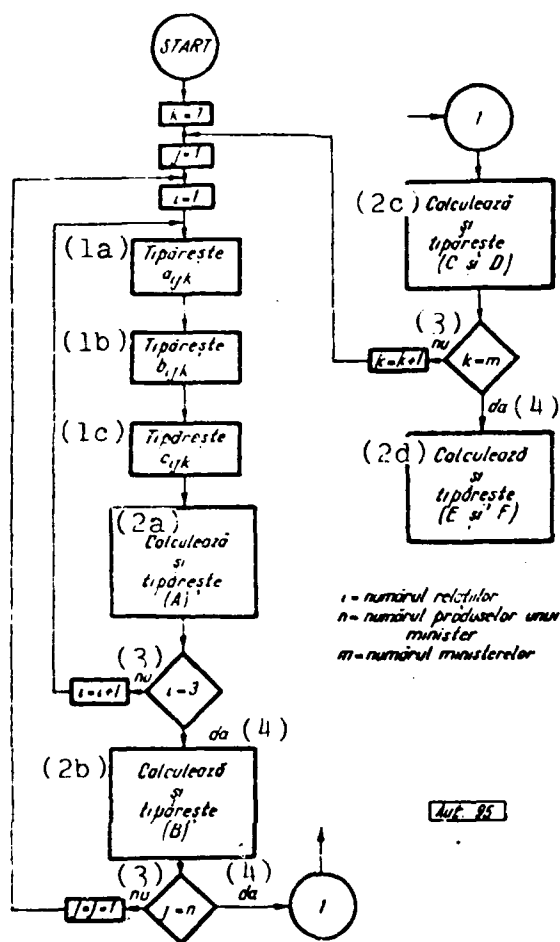


Figure 2. Logic diagram for computing the effects of export-import trade on the budget.

Key:

- 1a Write-in a_{ijk}
- 1b Write-in b_{ijk}
- 1c Write-in c_{ijk}
- 2a Compute and write (A)
- 2b Compute and write (B)
- 2c Compute and write (C) and (D)
- 2d Compute and write (E) and (F)
- 3 No
- 4 Yes
- i Number of relations
- n Number of products of a ministry
- m Number of ministries

* /Footnote from preceding page/ Average rates of exchange by product, by ministry for each relation, by ministry for all relations, by the national economy for each relation, and by the national economy for all relations.

(F) Indicatori	(10)	(1)	(2)	T-1		(5)	(6)	T			%	
	U.M.	T-2 efectiv	Plan inițial prevăzut în HCM	Plan actualizat	Realizări preliminare	Plan cincinal Conform HCM	Actualizat	Propuneri îmbunătățire			(10)	(11)
	0	1	2	3	4	5	6	Minister	Dir. de ramură	Pe scara act. or. et.	4/1	8/4
								7	8	9	10	11
(A) Ministerul Energiei Electrice												
A1) - energie electrică												
A2) - materiale de construcții												
A3) - construcții de mașini												
(B) Ministerul Minelor												
B1) - extracția minereurilor feroase												
B2) - nemetalifere și abrazive												
B3) - materiale de construcții												
B4) - cărbuni												
B5) - neferoase												
B6) - construcții de mașini												
B7) - alimentară												
(C) Ministerul Petrolului												
C1) - petrol												
C2) - gaz metan												
C3) - construcții de mașini												
C4) - nemetalifere												
(D) Celelalte ministere												
TOTAL		Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ		

Figure 3.

Key:

- A. Ministry of Electric Power
 - A1 Electric Power
 - A2 Building Materials
 - A3 Machine Building
- B. Ministry of Mines
 - B1 Mining Ferrous Ores
 - B2 Nonmetallic Substances and Abrasives
 - B3 Building Materials
 - B4 Coal
 - B5 Nonferrous Ores
 - B6 Machine Building
 - B7 Foodstuffs
- C. Ministry of Petroleum
 - C1 Petroleum
 - C2 Natural Gas
 - C3 Machine Building
 - C4 Nonmetallic Substances
- D. The other ministries
- E. Indicators
- F. Unit of measurement (Column 0)

/For key to columns see next page/

Key [continued from preceding page] (Fig. 3)

- Column 1. Effective T-2
 - Column 2. T-1. Original plan provided for in decision of the Council of Ministers
 - Column 3. T-1. Plan carried out to date.
 - Column 4. T-1. Predicted fulfillment.
 - Column 5. T. Five-year plan. According to decision of the Council of Ministers.
 - Column 6. T. Five-year plan. Carried out to date.
 - Column 7. T. Proposed improvements by ministry.
 - Column 8. T. Proposed improvements by branch directorate
 - Column 9. T. Proposed improvements by state organs.
 - Column 10. Percent 4/1 (Column 4 divided by Column 1)
 - Column 11. Percent 8/4 (Column 8 divided by Column 4)
- [T-2, T-1 and T not explained in text].

The totals by branch are calculated for each ministry:

$$\sum_{i=1}^m Y_{ik} \quad \text{for } k = 1, 2, \dots, 9;$$
$$\quad \quad \quad \text{for } i = 1, 2, \dots, n.$$

For the economy as a whole one calculates:

$$\sum_{i=1}^n \sum_{k=1}^m Y_{ik} \quad \text{for } k = 1, 2, \dots, 9.$$

The program was completed on two cards. With the aid of the first program one computes $\gamma_{im0}, \gamma_{im1}$, partial and total sums for columns 1, 4 and 8. In this case an overlay is placed over the table, covering all columns except 1, 4, 8, 10 and 11.

The second program completes the partial and full totals for columns $k = 2, 3, 5, 6, 7$ and $i = 1, \dots, n$.

This dividing up of the computation into two programs was due exclusively to the limited memory capacity of the computer.

Conclusions

Electronic office computers equipped with a limited number of memory registers can be applied to a number of problems encountered in calculations for design, administration and planning work.

Existing program libraries show the very limited use being made of these computers to compute the different tables encountered in administrative work.

In order to illustrate a number of possibilities for the use of electronic office computers in administrative work, examples have been given of the way to program and compute three tables and the manner in which the computers used can be made general use of in keeping with their applications and memory capacities.

Viewed from this standpoint, electronic office computers can be put to use for small projects that do not justify tying up a large computer, the capacity and availability of which should be earmarked for complex computation programs and for simulation at the level of an industrial branch, an important plan indicator or the national economy as a whole.

This article does not make any analysis of the importance of computing the effects of import-export trade on the budget, nor of the importance of computing any of the other tables mentioned; its sole purpose is to explain the method of computation followed.

Experience using small office computers for computations of the kind described in this article has shown that one can save 8 to 10 hours compared with the time required to carry out the same computations using mechanical calculators. This saving in time makes it possible to carry out more detailed technical-economic analyses and to carry out certain calculations and obtain some results that could not be achieved using conventional calculators.

- END -