M. STOICA
CAMELIA RAȚIU-SUCIU
D. CHIRA
I. DOBRE
Economic Cybernetics Department
Academy of Economic Studies

Simulating Inventory Stochastic Processes

A constant objective of modern economic management is the maintenance of stocks at an optimum level.

This level must ensure the continuity of the production process, at the same time immobilizing a minimum volume of circulating means.

The authors tackle problems of stock management in the hypothesis of inventory stochastic processes without and with adjustment, in the solving of which they use the simulation method. The logical schemes of processing on the IBM/370 computer are presented.

1. INTRODUCTION

The stocking of various raw and related materials and semifabs necessary for production implies within the complex technical-material supplying process, a number of costs influencing the technical-economic indices of an enterprise.

This should be dimensioned so as to equilibrate the current needs, namely to avoid production stagnation due to the lack of stock, under conditions of minimum holding cost. It results that the decisions as regards stocks dimensioning should be substantiated by taking into consideration some parameters, such as for example the volume of demands (on assortments), the supply time, various costs (holding cost, set up cost, penalty etc.), the supplying, storage and stocking conditions. This leads to a huge number of variants possible which must be analysed on the basis of the most significant economic criteria. The analysis of these variants of dimensioning the volume of stocks is liable to be carried out with the aid of digit simulation, the only method which within the limits of a precision practically admissible can tackle the complex aspects of problems, without the time of processing the considered parameters becoming prohibitorily long.

One of the main parameters of the inventory processes is the demand for a certain period of time. For a certain raw or related material, the demand for a period of time may be known or unknown.

In practice, the demands of raw and related materials on assortments and for various periods of time are strictly known. For these cases, there are in the specialist literature many mathematical methods known as *inventory deterministic models* [3, 7].

The second big category of inventory processes are *the inventory (stochastic) probabilistic models* in case the demand is known with certain probability. The demand, being strictly unknown for the next plan period, it is determined on the basis of studies on its evolution for a previous significant period (for example, a year in case of the approximately constant production and two years for seasonal production). The results of these studies are materialized in the demand distribution law.

Worth mentioning among the multitude of stochastic models are especially those which admit with certain probability the lack of stock at a given moment. The problem lies in establishing the stock's minimum level which allows for the evolution of the production process with economic performances as close to the optimum as possible. This problem can be treated in two hypotheses:

a) each material enters the composition of a single product;

b) there are materials which enter the composition of several products.

Further, certain Monte-Carlo simulation methods are presented of inventory processes in these two hypotheses.

2. SIMULATING INVENTORY PROCESSES IN THE CASE OF A SINGLE MAIN COMPONENT OF THE PRODUCT

For such products, the inventory process of the respective material is regardless of the events taking place with other materials. In this situation, each material can be examined separately:

Thus, in this case, the constraints of the system are:

$$P(c_p > S_0) \leqslant P_a \tag{1}$$

$$P(s_g + \Delta S_c - \bar{C}_p < 0) \leqslant P_a \tag{2}$$

where:

c_p — represents the random demand in a period;
$\bar{c}_p$ — the mean of this variable;
S_0 — the stock's optimum level;
P_a — the admissible probability of the stock break;
ΔS_c — the stock variation in the period prior to the making of the analysis;
s_g — safety stock.

The optimizing criterion, respectively the minimizing of the total holding cost and of the penalty cost is given by:

$$CTOT_{min} = min[P_S \cdot \delta\bar{T} \cdot \bar{s} \cdot C_S + P_a \Delta\bar{T} \cdot \bar{S}_l \cdot C_r] \tag{3}$$

where:

$CTOT$ — represents the total cost;
P_s — the probability of having a stock;
$\delta\overline{T}$ — the period in which there is a stock;
$\bar{s}$ — the inventory average;
C_s — the holding cost;
$\overline{\Delta T}$ — the average time interval in which the stock break occurs;
S_l — the average level of the lack of stock;
C_r — the penalizing cost for the stock break.

It has resulted from the many analyses made on practical cases that in case that the outputs from the stock are reduced in number, it can be considered that demand (c_g) follows a Poisson type law. In case of more frequent outputs from the stock, demand c_g follows a law tending towards normal (with the mean $\bar{C}_g$ and dispersion σ^2).

In the cases analysed, the type of management with *periodical inventories* was used. These inventories aim at adjusting the stocking processes determined by various "movements": inputs-outputs, into and out of the stores where the examined raw and related materials are stocked. The resupply order is launched with a view to bringing the stock to a level s_0 which sees to the fact that the probability of the lack of stock between two inventories running does not surpass a given limit s_1. By this, the obtaining of an equilibrium between the "useless" stocking for a certain period of time of a certain material and its lack in another period of time is pursued (which might lead to a production stagnation).

Algorithms and simulation programs have been elaborated for three types of representative inventory stochastic processes, frequently found in economic practice, namely inventory processes without adjustment, inventory processes with adjustment and seasonal supplying processes with periodical consumption.

Inventory processes without adjustment refer to a relatively small period of management , in which the decision-maker having established the process parameters can no longer intervene. This is the case of important materials which the orders having been made, they can be changed only with the elaboration of a new import plan.

The simulation program can, however, be used also in the case of current cases for establishing the limits ef economic performances in case of a rigid system, in which one can no longer intervene in the period of time between two decisions running (though various perturbations may occur in this period).

Inventory processes with adjustment refer to a practically unlimited period of time, in which the decision-maker establishes both the initial parameters of the process and the operative decision rules in the event of perturbations. Taking into account the fact that the inventory processes without adjustment were treated in other papers as well [6], we shall further present only the inventory processes with adjustment (which, in fact, by particularizing certain processes, include the inventory processes without adjustment).

In keeping with the frequency ψ_{hk} of consumptions c_k for the period τ_h, the decision-maker concludes contracts with the suppliers, establishing

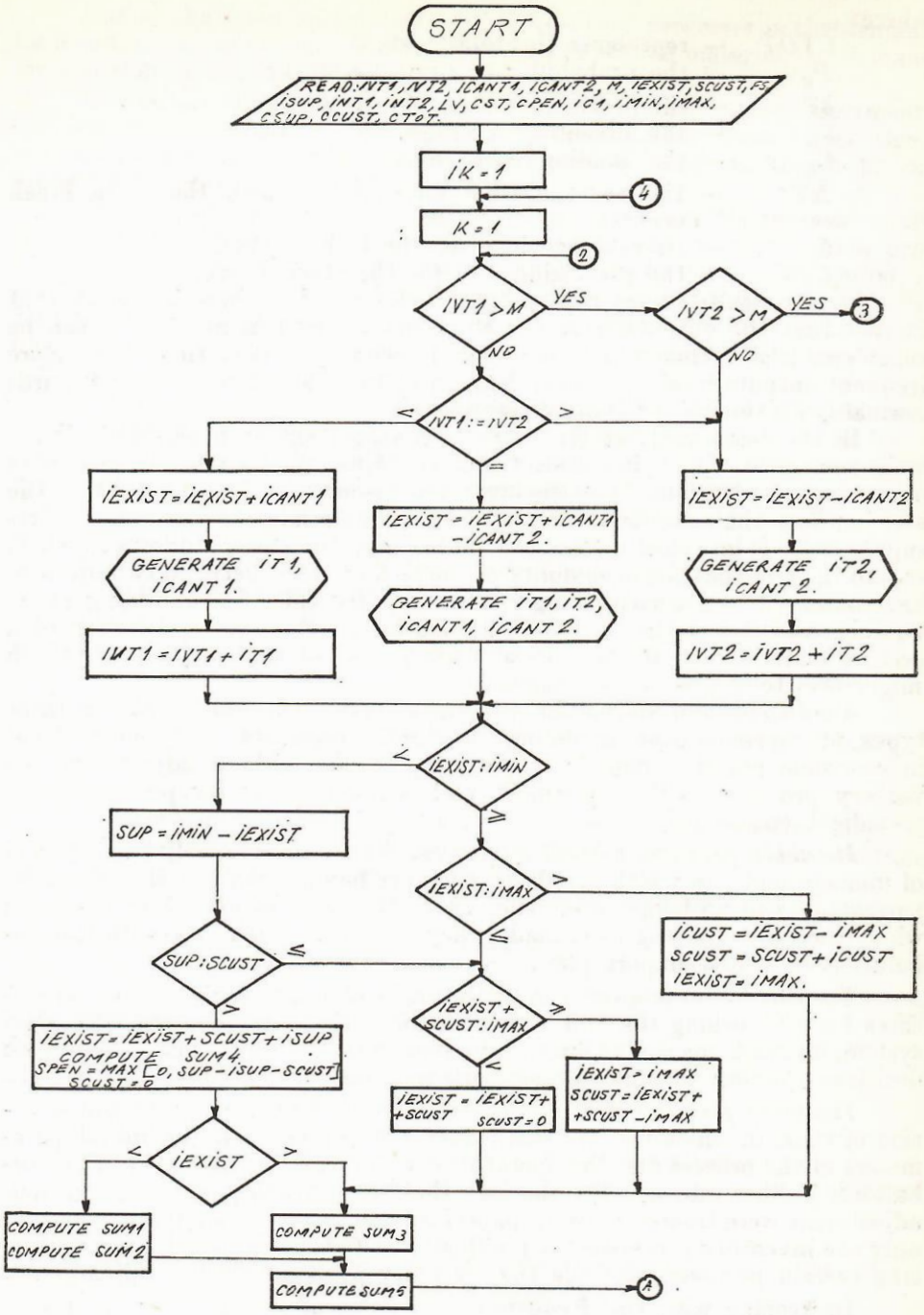

START
READ: INT1, INT2, ICANT1, ICANT2, M, IEXIST, SCUST, FS, ISUP, INT1, INT2, LV, CST, CPEN, IC1, IMIN, IMAX, CSUP, CCUST, CTOT.
IK = 1
4
K = 1
2
IVT1 > M
YES
IVT2 > M
YES
3
NO
NO
IVT1 : = IVT2
<
=
>
IEXIST = IEXIST + ICANT1
IEXIST = IEXIST + ICANT1 - ICANT 2.
IEXIST = IEXIST - ICANT2
GENERATE IT 1, ICANT 1.
GENERATE IT1, IT2, ICANT1, ICANT 2.
GENERATE IT2, ICANT 2.
IVT1 = IVT1 + IT1
IVT2 = IVT2 + IT2
IEXIST : IMIN
SUP = IMIN - IEXIST
IEXIST : IMAX
ICUST = IEXIST - IMAX
SCUST = SCUST + ICUST
IEXIST = IMAX.
SUP : SCUST
IEXIST = IEXIST + SCUST + ISUP
COMPUTE SUM4
SPEN = MAX [0, SUP - ISUP - SCUST]
SCUST = 0
IEXIST + SCUST : IMAX
IEXIST = IEXIST + SCUST
SCUST = 0
IEXIST = IMAX
SCUST = IEXIST + SCUST - IMAX
IEXIST
COMPUTE SUM1
COMPUTE SUM2
COMPUTE SUM3
COMPUTE SUM5
A

Fig. 1A

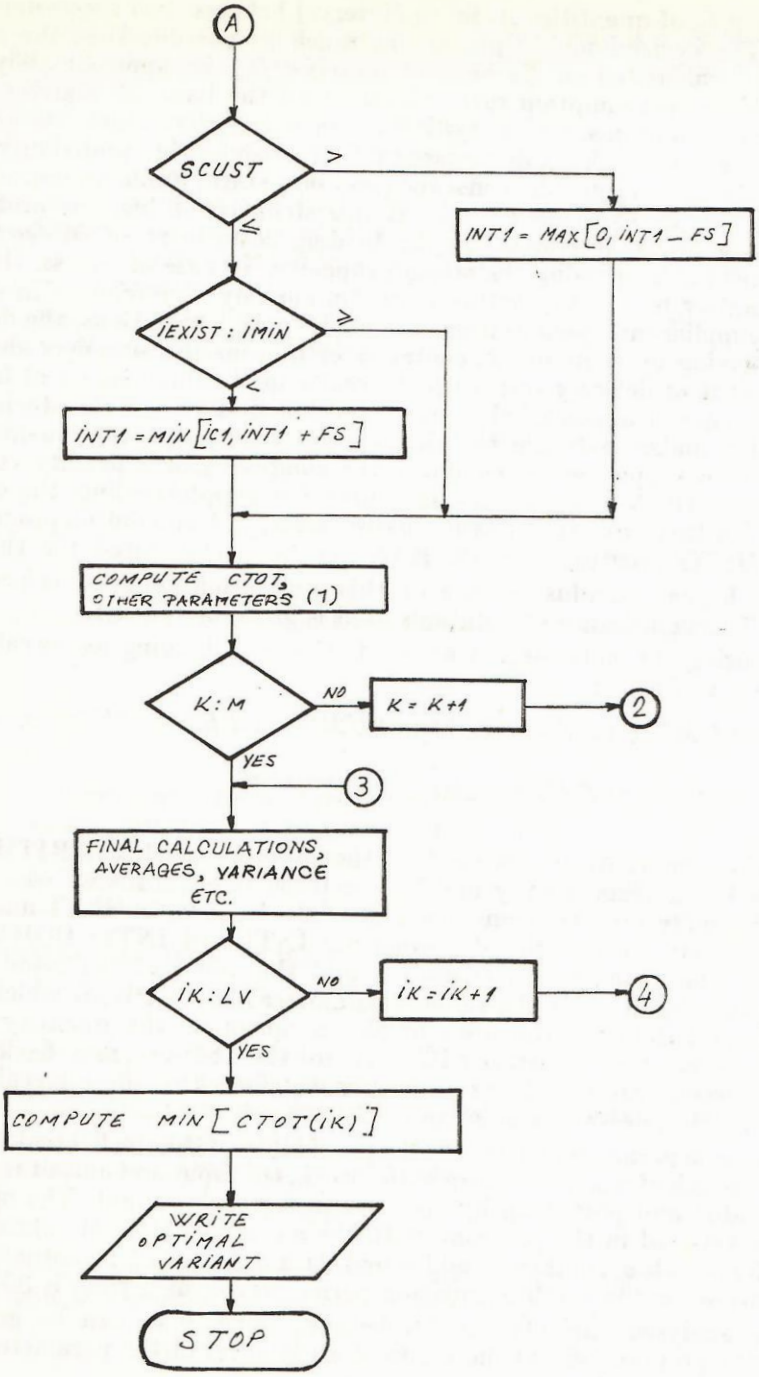

A
SCUST
>
≤
INT1 = MAX [0, INT1 – FS]
IEXIST : IMIN
≥
<
INT1 = MIN [IC1, INT1 + FS]
COMPUTE CTOT, OTHER PARAMETERS (1)
K : M
NO
K = K+1
2
YES
3
FINAL CALCULATIONS, AVERAGES, VARIANCE ETC.
IK : LV
NO
IK = IK+1
4
YES
COMPUTE MIN [CTOT(IK)]
WRITE OPTIMAL VARIANT
STOP

Fig. 1B

a frequency f_{ij} of quantities A_i in the interval between two successive resupplies θ_i. The decision-maker pursues as much as possible that the average supply rate calculated on the basis of matrix $\| f_{ij} \|$ be approximately equal to the average consumption rate calculated on the basis of matrix $\| \varphi_{hk} \|$. Under these conditions, if one starts from an initially nul stock, the probability of the stock break tends towards 0.5. To reduce this probability which has unfavourable economic consequences, one starts from an initial stock determined on an experiment basis. If this stock is too big, the probability of the stock break decreases but the holding costs increase. Moreover, the danger exists of surpassing the storing capacity. In case of excess, the additional quantity is sent to another store "in custody" (or remains in custody with the supplier) and penalizations are paid. In such situations, the decision-maker is giving up some of the contracts or informs the suppliers about the postponement of delivery terms which results in the diminishing of frequencies f_{ij}. In case of a stock below the admitted limits or of the stock break, the decision maker is trying to bring, in the first place, the quantities in custody or to supplement even under the conditions of a penalty cost, the existing quantities and to take measures for supplementing the existent contracts, in this way for increasing frequencies f_{ij}. A simulation program entitled SIMSTOC written in FORTRAN has been elaborated for this case.

The logical calculus scheme of this simulation program is presented in fig. 1. The significance of notations used is given in annex 1.

By using the notations in annex 1, the total holding cost is calculated with the aid of ratio:

$$CTOT = SUM3 \times CST + SUM2 \times SUM1 \times CPEN + SUM4 \times \times CSUP + SUM5 \times CCUST \tag{4}$$

Various subroutines are used in the program, such as: RITM which calculates the average supply and consumption rates; TRANS which tranforms the matrix of noncumulation absolute frequencies INTI and INT2 into the matrix of cumulated frequencies INT1 and INT2; DORA which determines the time growth (variable) and the value of the input/output quantity in keeping with the value of parameter NINT; PROB which determines the probability of the stock break, the mean of the quantity is definite and the mean of the stock; RANDU (of the SSP program deck) which generates pseudo random digits uniformly distributed in the interval (0; 1); MINIM which selects the minimum CTOT cost.

The main parameters, namely: the probability of the stock break, the mean of the lack of stock, the mean of the stock, the input and output rates, etc. are calculated and posted up by comparison for each variant. The optimum variant is selected in the program, with the aid of the MINIM subroutine, a variant for which a number of additional data are printed (eventually, even the evolution for the whole simulation period which, as a rule, is 365 days).

The analysed variants can be declared initially or can be generated through the program within the limits of an interval of the parameter which has to be optimized.

In the event of a seasonal supply the average rate is variable in time. The production may also have a periodical character. Three possible cases are thus resulting:

— a seasonal supply and a continuous production;
— a continuous supply and a periodical production;
— a seasonal supply and a periodical production;

The variation in time of the supplied quantities and of the consumed (used) quantities once established, the system's simulation takes place similarly with the previous example in which both (supply and production were considered "continuous").

The input (supply) and respectively output (consumption) functions may have various forms. Such function may be:

$$\psi(t) = \begin{cases} 0 & t \in (0, T_1) \\ m(t - T_1), & t \in (T_1, T_2) \\ \bar{Q} \cdot k, & t \in (T_2, T_3) \\ -m(t - T_3), & t \in (T_3, T_4) \\ 0, & t \in (T_4, T) \end{cases} \tag{5}$$

where coefficient K has a generally random character, namely:

$$K = 1 + k \frac{\sigma_Q}{\bar{Q}} \mu^{2\gamma+1} \tag{6}$$

and where:

$\bar{Q}$ — represents the average quantity necessary per time unit;
σ_Q — the quadratic mean deviation;
k — the coefficient of likely probability;
μ — pseudorandom digit generated in the interval $(-1, 1)$
γ — a whole, supraunitary exponent established by experiments.

Parabolic variations of the form:

$$\bar{Q} = K(at^2 + bt + c) \tag{7}$$

can be considered in other cases, where K may be taken 1, in case ratio (7) is established with some certainty, or of the form (6) in the opposite case.

There are situations in which the inputs or outputs have a sinusoidal character, which may be:

— without any tendency of increasing in time:

$$Q = a \sin(\omega t + \varphi) + b + u \tag{8}$$

where a,b and ω are experimental coefficients and u a random residue:

— with a tendency of increasing in time:

$$Q = \alpha t + \beta + \gamma \sin(\omega t + \varphi) + u \tag{9}$$

where α, β and γ are experimentally established coefficients.

In the last few years, applications of the spectral analysis for the simulation of processes with a periodical character have been presented in the specialist literature [2].

By simulating the supplying or inventory processes with a seasonal and periodical character, certain time intervals can be delimited in which the stock exceeds with great probability the admissible maximum or minimum limits, a fact which allows the decision-maker to take efficient measures long before the occuring of these anomalies.

3. SIMULATING INVENTORY PROCESSES IN THE CASE OF SEVERAL MATERIALS ENTERING THE PRODUCT'S COMPOSITION

The existence of some materials entering the composition of one or several products complicates the inventory problem. Two cases are distinguished for such situations:

Case 1. Each product can be obtained with the aid of single recipes. To model the inventory processes we shall consider a management period T which is divided into equal periods (for example, weeks). The necessary products to be obtained in period t is:

$$X_i(t) = W_i(t) - X_i^{**}(t), \quad i = 1, 2, .., p; \quad t = 1, 2, ..., T \tag{10}$$

where: $X_i(t)$ — the necessary products to be carried out in period t;
$W_i(t)$ — represents the demand for product P_i in the period of range t;
$X_i^{**}(t)$ — the existent stock of product P_i in period t.

In order to satisfy the demands it is necessary to verify the following constraints:

$$\sum_{i=1}^{p} c_k^i X_i(t) \leqslant S_k(t); \quad k = 1, 2, ..., n, \quad t = 1, 2, ..., T \tag{11}$$

where:

c_k^i — represents the specific consumption of material
$M_k (k = 1, 2, ..., n)$ for the product $P_i (i = 1, 2, ..., p)$
$S_k(t)$ — the existing stock of the material M_k at moment t.

If these conditions are fulfilled for all n materials, in this case all the products demanded for period t can be achieved. If materials M_k exist for which constraint (11) is not satisfied, it is considered that a quantity $\widetilde{X}_i(t)$ is achieved out of each product, satisfying constraints:

$$0 \leqslant \widetilde{X}_i(t) \leqslant X_i(t), \quad i = 1, 2, ..., p; \quad t = 1, 2, ..., T \tag{12}$$

The optimum criterion is:

$$max\left[\sum_{i \in I^1} (C_i + L_i)\, \widetilde{X}_i(t) + \sum_{j \in I^2} C_j \widetilde{X}_j(t)\right] \tag{13}$$

$$I^1 = \{i \in I \mid \widetilde{X}_i(t) < X_i(t)\}; \quad I^2 = \{i \in I \mid \widetilde{X}_j(t) = X_i(t)\};$$

$$I = \{1, 2, ..., p\}$$

where:

L_i — represents the penalty cost for the notfulfilment of a unit out of product P_i,

C_i — the benefit from a product unit.

It results that a discontinuous function is obtained by using ratio (13). To avoid the treatment of a model with an objectively discontinuous function, the following transformation of variable can be made:

$$y_i(t) = X_i(t) - \widetilde{X}_i(t) \geqslant 0 \tag{14}$$

The variables of the system become:

$$\widetilde{X}_i(t) = X_i(t) - y_i(t) \tag{15}$$

and constraints (11):

$$\sum_{i=1}^{p} c_k^i (X_i(t) - y_i(t)) \leqslant S_k(t)); \quad k = 1, 2, ..., n, \quad t = 1, 2, ..., T \tag{16}$$

Under these conditions, the optimum criterion becomes:

$$max\left[\sum_{i=1}^{p} (C_i + L_i)\,(X_i(t) - y_i(t))\right] \tag{17}$$

or

$$min\left[\sum_{i=1}^{p} (C_i| + L_i)\, y_i\right]$$

In this way, we have come to a linear programming model which is solved for the first period (vector $S_k(1)$ being known).

For the other periods, we must solve a problem of reoptimizing the free terms vector ($S_k(t)$) which is calculated on the basis of ratio:

$$S_k(t) = S_k(t-1) - \sum_{i=1}^{p} c_k^i \widetilde{X}_i(t-1) + A_k(t); \quad t = 2, 3, ..., T;$$

$$k = 1, 2, ..., n \tag{18}$$

where $A_k(t)$ represents the supplied quantities of material M_k for the current period t (which may have a random character although it is generated by the program). By solving the linear programming model we can calculate the dual variables $u_k(t)$ corresponding to the constraint of range k in (16), that is material M_k.

If $u_k(t) > 0$ it means that in period t, material M_k was critical (it was entirely consumed). On the contrary, if $u_k(t) = 0$, it means that material M_k has raised no problems and it has remained in the stock, that is:

$$S_k(t) - \sum_{i=1}^{p} c_k^i \widetilde{X}_i(t) > 0 \tag{19}$$

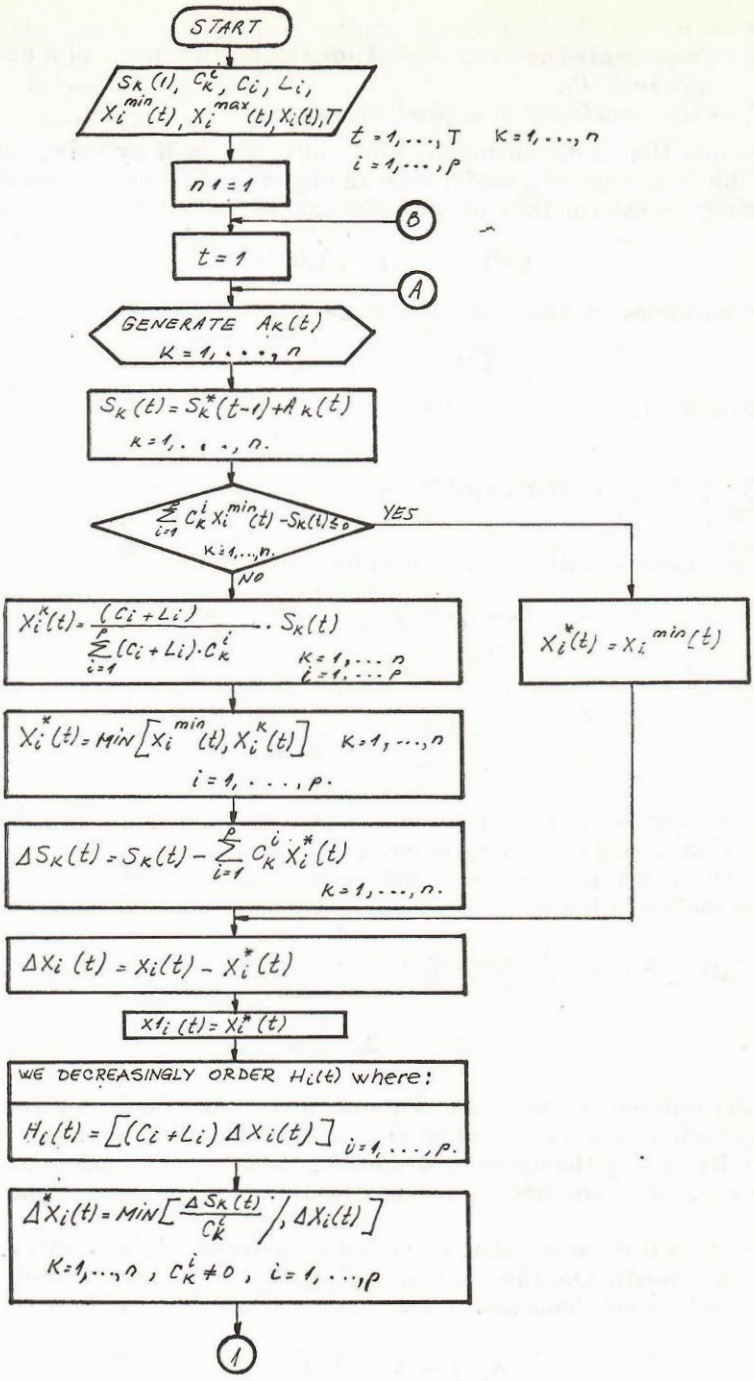

START
$S_k(1)$, C_k^i, C_i, L_i, $X_i^{min}(t)$, $X_i^{max}(t)$, $X_i(t)$, T
$t = 1, \ldots, T$ $k = 1, \ldots, n$ $i = 1, \ldots, p$
$n1 = 1$
B
$t = 1$
A
GENERATE $A_k(t)$ $k = 1, \ldots, n$
$S_k(t) = S_k^*(t-1) + A_k(t)$ $k = 1, \ldots, n$.
$\sum_{i=1}^{p} C_k^i X_i^{min}(t) - S_k(t) \leq 0$ $k = 1, \ldots, n$.
YES
NO
$X_i^k(t) = \frac{(C_i + L_i)}{\sum_{i=1}^{p}(C_i + L_i) \cdot C_k^i} \cdot S_k(t)$ $k = 1, \ldots n$ $i = 1, \ldots p$
$X_i^*(t) = X_i^{min}(t)$
$X_i^*(t) = MIN\left[X_i^{min}(t), X_i^k(t)\right]$ $k = 1, \ldots, n$ $i = 1, \ldots, p$.
$\Delta S_k(t) = S_k(t) - \sum_{i=1}^{p} C_k^i X_i^*(t)$ $k = 1, \ldots, n$.
$\Delta X_i(t) = X_i(t) - X_i^*(t)$
$X1_i(t) = X_i^*(t)$
WE DECREASINGLY ORDER $H_i(t)$ where:
$H_i(t) = \left[(C_i + L_i)\, \Delta X_i(t)\right]$ $i = 1, \ldots, p$.
$\Delta^* X_i(t) = MIN\left[\frac{\Delta S_k(t)}{C_k^i}, \Delta X_i(t)\right]$
$k = 1, \ldots, n$, $C_k^i \neq 0$, $i = 1, \ldots, p$
1

Fig. 2A

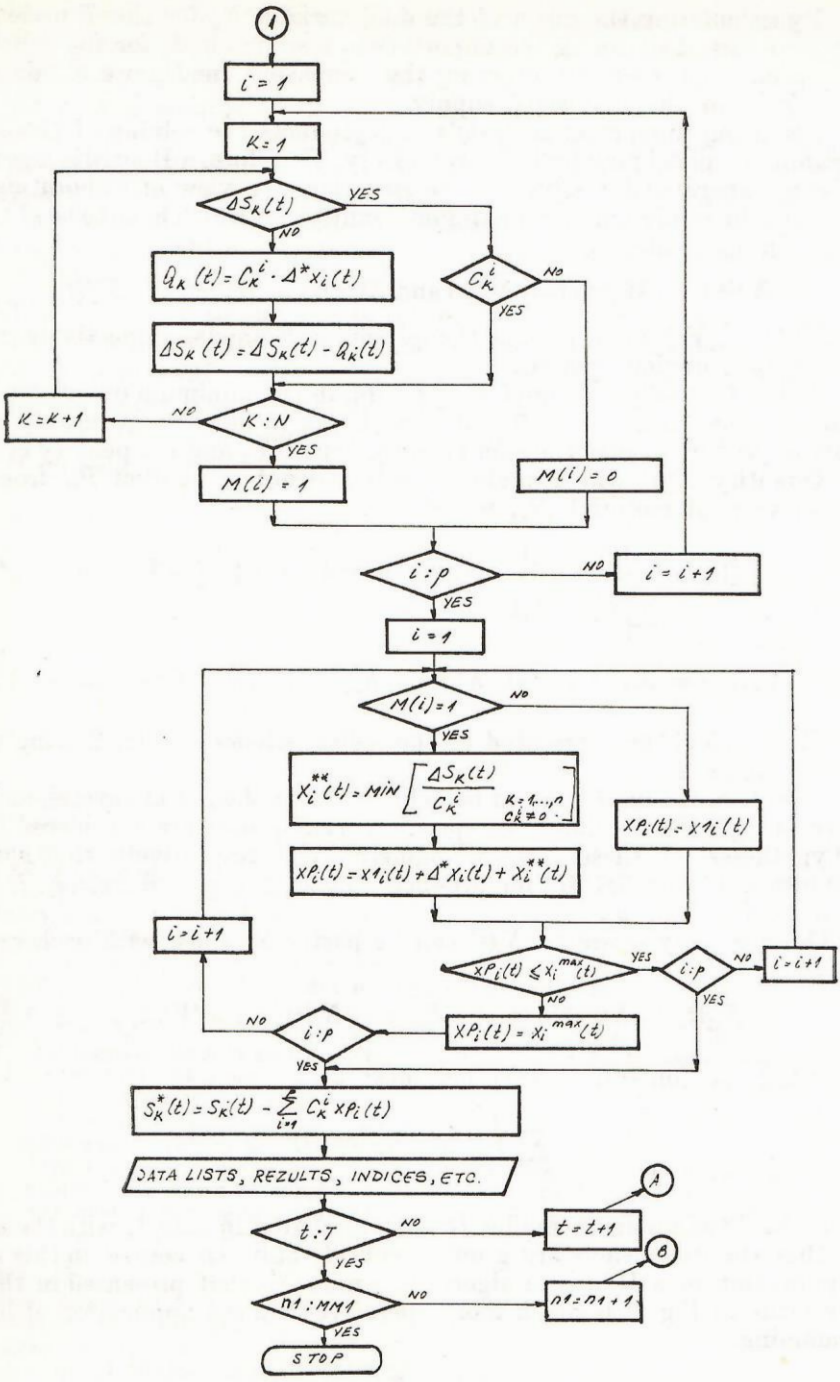

1
i = 1
K = 1
ΔS_K(t)
YES
NO
Q_K(t) = C_K^i · Δ* x_i(t)
C_K^i
NO
YES
ΔS_K(t) = ΔS_K(t) - Q_K(t)
K = K+1
NO
K : N
YES
M(i) = 1
M(i) = 0
i : p
NO
i = i+1
YES
i = 1
M(i) = 1
NO
YES
X_i^** (t) = MIN [ΔS_K(t) / C_K^i] K = 1,...,n, C_K^i ≠ 0
XP_i(t) = X1_i(t)
XP_i(t) = X1_i(t) + Δ* X_i(t) + X_i^**(t)
i = i+1
XP_i(t) ≤ X_i^max(t)
YES
NO
i : p
NO
i = i+1
YES
NO
i : p
XP_i(t) = X_i^max(t)
YES
S_K^*(t) = S_K(t) - Σ_{i=1}^{n} C_K^i XP_i(t)
DATA LISTS, REZULTS, INDICES, ETC.
A
t : T
NO
t = t+1
B
YES
n1 : MM1
NO
n1 = n1+1
YES
STOP

Fig. 2B

By calculating the mean of the dual variable U_k for the T periods, an index is obtained outlining the importance of material M_k for the fulfilment of the production plan. By ordering the decreasing line $\bar{U}_k$, we obtain a list of priorities in the materials' supply.

For a big number of materials and products the solving of this linear programming model may become prohibitory. Therefore, a Heuristic algorithm has been elaborated for solving these situations. In view of elaborating this algorithm, the minimum and maximum quantitaties which have to be obtained have been calculated:

$$X_i^{min}(t) = W_i^{min}(t) - X_i^{**}(t) \text{ and } X_i^{max}(t) = W_i^{max}(t) - X_i^{**}(t) \tag{20}$$

where $W_i^{min}(t)$, $W_i^{max}(t)$ represent the minimum demands, respectively maximum of the previous period.

In the first stage, we are trying to obtain the minimum quantities $X_i^*(t)$ which are equal either to $X_i^{min}(t)$ (if possible), or in more unfavourable cases, to part of proportional to the sum between benefit C_i and the penalty cost L_i.

Quantity $X_i^k(t)$ which might be obtained out of product P_i, from the point of view of material M_k, would be:

$$X_i^k(t) = \frac{(C_i + L_i)}{\sum_{i=1}^{p} C_i + L_i)\, c_k^i} S_k(t), \quad k = 1, ..., n; \quad i = 1, ..., p \tag{21}$$

$$\Rightarrow X_i^*(t) = Min\,[X_i^{min}(t),\ X_i^k(t)], \quad k_i^k = 1, ..., n; \quad i = 1, ..., p \tag{22}$$

These calculi are presented in the logical scheme in Fig. 2 using notations in annex 2.

Case 2. Some products can be achieved with the aid of several recipes: In case of r possible recipes, the specific consumptions are considered in all the hypotheses of these recipes, namely $\| c_{is}^k \|$ respectively the specific consumption of material M_k for product P_i with the aid of recipe $R_s (k = 1, ..., n;\ i = 1, ..., p)$.

The necessary quantity $X_i(t)$ can be partly obtained with each recipe, namely:

$$X_{i1}(t) + X_{i2}(t) + ... + X_{ir}(t) = X_i(t); \quad i = 1, ..., p \tag{23}$$

The system of constraints (11) becomes:

$$\sum_{i=1}^{p} \sum_{s=1}^{r} c_{is}^k X_{is}(t) \leqslant S_k(t) \tag{24}$$

In rest, the model is similar to that presented in case 1, with the difference that the dimensions are growing considerably. Of course, in this case) the application of a Heuristic algorithm similar to that presented in the logical scheme in Fig. 2 is much more operative than the application of linear programming.

* * *

The taking into consideration of the stochastic character of the supply-inventory processes allows for a greater approach of models in the theory of stocks to the concrete economic problems.

As it was pointed out, these processes can be simplified — without adjustment or complex — with adjustment. The tackling of the supply-inventory processes with adjustment leads to the working out of more realistic strategies which can be easier put into practice and which are closer to the economic optimum. It has resulted after some experiments made that adjustment secures both the reduction of the average level of the stock and of the risk of the stock-break.

The simulation of the supply-inventory processes offers the possibility of an economic analysis for many variants. The decision maker has the possibility to gain experience on simulated systems before working effectively in an integrated data processing system. On the basis of the experience gained, the decision-maker can improve the parameters of the supply-inventory process already in the design stage.

ANNEX 1

SYMBOLS USED IN FIGURE 1

LV — number of considered variants;
CST — holding cost
$CPEN$ — penalty cost
$INT1$, $INT2$ — noncumulated/cumulated frequency matrices for inputs respectively outputs;
IK — cycling index for simulation
IX — initializing value for subroutine RANDU;
K — cycling index for time periods,
$IEXIST$ — the value of the existent in the store at a given moment
IVT_1, IVT_2 — current value of the day for inputs respectively outputs
IT_1, IT_2 — current values of time growth (for inputs, respectively outputs)
$ICANT_1$, $ICANT_2$ — current value of input respectively output quantities
IC_1, IC_2 — maximum value of absolute frequency for matrices INT_1 respectively INT_2
$SUM\ 1$ — probability of stock's break
$SUM\ 2$ — mean of the lack of stock
$SUM\ 3$ — mean of stock
FS — supplementary frequency
$IMIN$, $IMAX$ — minimum respectively maximum admissible values of the existent stock
$ISUP$ — quantity which can be supplemented in case of stock break
$CSUP$ — penalization in case of supply with the $ISUP$ supplementary quantity
$SUM\ 4$ — mean of daily supplementations
$SCUST$ — stock in custody
$CCUST$ — unitary cost of stock in custody
$SUM\ 5$ — average stock in custody
$CTOT$ — total stocking cost
M — management period
$SPEN$ — stock of lacking materials which is penalized
SUP — quantity which must be supplied for bringing the stock back to the minimum limit

SPECIFICATIONS OF NOTATIONS IN FIGURE 2

$\Delta S_k(t)$ — stock of raw and related materials at moment t, after the obtaining of quantities $X_i^*(t)$, $\Delta X_i(t)$ — rest of products to be achieved, after the obtaining of quantity $X_i^*(t)$
$\Delta^* X_i^*(t)$ — quantity likely to be achieved out of product P_i (after the obtaining of quantity $X_i^*(t)$;
$Q_k(t)$ — quantity of material consumed for obtaining the product at moment t
$X_i(t)$ — quantity obtained beforehand

$$M(i) = \begin{cases} -1 \text{ if more than } X_i^*(t) \text{ can be achieved} \\ 0 \text{ if only } X_i^*(t) \text{ is achieved} \end{cases}$$

$XP_i(t)$ — the planned quantity to be obtained

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LA SIMULATION DES PROCESSUS STOCHASTIQUE DE STOCKAGE

Maintenir les stocks à un niveau optimal représente l'objectif constant de la gestion économique moderne. Ce niveau doit assurer la continuité du processus productif tout en immobilisant un volume minimum de moyens circulants.

Les auteurs abordent les problèmes de la gestion des stocks dans l'hypothèse de certains processus stochastiques de stockage avec et sans régulation, à la solution desquels ils appliquent la méthode de la simulation . Y sont présentés des schémas logiques pour le traitement à l'aide de l'ordinateur IBM/370.

СТИМУЛИРОВАНИЕ СТОХАСТИЧЕСКИХ ПРОЦЕССОВ ЗАГОТОВКИ

Постоянной задачей хозяйственного учёта в современных условиях это сохранение заготовок на оптимальном уровне. Этот уровень должен обеспечить продолжение производственного процесса, замораживая в то же время минимальный объём оборотных средств.

Авторы рассматривают вопросы учёта заготовок ввиду процессов стохастических заготовок с регулированием и без регулирования, в разрешении которых они используют метод стимулирования. Представлены логические схемы обработки на вычислителе IBM/370.

21.08.1974