

SCIENCE, INNOVATIONS AND EDUCATION: PROBLEMS AND PROSPECTS



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SIMULATION MODELING OF ELECTRONIC EQUIPMENT SALES

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Abstract: Selected statistics on the implementation by a commercial firm of components such as microprocessors, printers and monitors that are part of personal computers. In order to prevent loss of profits in case of unsatisfactory demand, simulation was performed to determine the adequacy of stocks in the company's warehouses.

Keywords: microprocessors, monitors, printers, implementation of simulation.

The work considers the demand for microprocessors, monitors and printers implementation in a single commercial firm.

The amount of demand for any particular day is unpredictable, although as a result of systematic monitoring of the demand and sale of computer equipment and its components, it was revealed that daily demand for components for personal computers fluctuates on average from 0 to 40 pieces, depending on the type of components. The probability or frequency of a given number of processors per day is expressed as a percentage. It is determined by the results of the prevailing trends empirically. The total value of the percentage frequency must be 100%. The result of the analysis of demand according to the data of the manager of commercial firms, the percentage frequency (probability) of daily demand for the number of products is presented in table. 1-3.

A generator of random numbers is used, distributed uniformly in the range from 0 to 99. Moreover, the first 7% of these numbers are considered to correspond to zero demand. The next 10% of these numbers will represent the demand for 1 microprocessor. The demand for 2 and 3 processors, respectively, is represented by the next 15 and 25%, etc. up to 7 pcs., which correspond to 4% of random numbers in the selected interval. All this is reflected in the table. 2.4 in such a way that any random number between 0 and 6 will indicate zero demand, between 7 and 16 for a demand equal to 1 microprocessor, etc. The obtained values of demand for a certain forecast period of time will correspond to the initial percentage distribution of one-day demand.

Table 1

Choosing random numbers to model the demand for microprocessors

Daily demand (number of processors), pcs.	0	1	2	3	4	5	6	7
Percentage frequency (probability) of realization, %	7	10	15	25	22	9	8	4
Random numbers	0÷6	7÷16	17÷31	32÷56	57÷78	79÷87	88÷95	96÷99

Table 2

Choosing random numbers to simulate demand for monitors

Daily demand (number of monitors), pcs.	0	1	2	3	4	5	6	7
Percentage frequency (probability) of realization, %	2	3	8	20	40	14	8	5
Random numbers	0÷1	2÷4	5÷12	13÷32	33÷72	73÷86	87÷94	95÷99

Table 3**Choosing random numbers for demand modeling on printers**

Daily demand (number of printers), pcs.	0	1	2	3	4	5
Percentage frequency (probability) of realization, %	24	30	23	15	5	3
Random numbers	0÷23	24÷53	54÷76	77÷91	92÷96	97÷99

A model simulating work with microprocessors for LLC "MAXIMA" is shown in table. 4-6, where the demand is set according to the corresponding random numbers, distributed over intervals relative to the probabilities of implementation in table. 1-3.

In the simulated process, the firm expects to deliver goods in an average of seven days. In the event of a premature depletion of stock, deliveries will be made at an earlier period. If there is an excess of components, the delivery is made at a later period [1, p,45].

The stock size is checked at the beginning of each day. If it falls below the maximum demand in three days, new orders are placed. The delivery of a new batch is possible no earlier than three days from the date of ordering.

The order size for a new batch in this model is defined as the difference between the average number of sales for 10 days of products (week plus three days for delivery of the product) and the initial balance of products on the day of order. No other orders will be placed until the current order is received.

The amount of stocks at the beginning of each subsequent day is equal to the amount of stocks at the beginning of the previous day plus receipts and minus sales. Sales proceeds are determined by multiplying the quantity of goods sold by their price. The cost of preparing the goods includes the cost of the goods, shipping and storage costs.

Unmet demand arises from scarcity. It is equal to the sum of the excess of demand over the value of goods sold or available in stock. In this situation, there is unsatisfied demand.

Table 4

Simulation of results from the implementation of microprocessors

Day	Random numbers	Stocks at the beginning of the period, pcs.	Placed orders, pcs.	Orders received, pcs.	Demand, pcs.	Sold, pcs.	Unsuccessful demand, pcs.	Sales proceeds, UAH	Expenses		Total costs, UAH	Profit, UAH
									for preparation of goods, UAH	due to deficit, UAH.		
1	50	22	0	0	3	3	0	1050,00	900,00	0	900,00	150,00
2	5	19	20	0	0	0	0	0	30,00	0	30,00	-30,00
3	36	19	0	0	3	3	0	1050,00	900,00	0	900,00	150,00
4	33	16	0	0	3	3	0	1050,00	900,00	0	900,00	150,00
5	34	13	0	20	3	3	0	1050,00	900,00	0	900,00	150,00
6	96	30	0	0	7	7	0	2450,00	2100,00	0	2100,00	350,00
7	98	23	0	0	7	7	0	2450,00	2100,00	0	2100,00	350,00
8	97	16	23	0	7	7	0	2450,00	2130,00	0	2130,00	320,00
9	87	9	0	0	5	5	0	1750,00	1500,00	0	1500,00	250,00
10	81	4	0	0	5	4	1	1400,00	1200,00	50,00	1250,00	150,00
11	18	0	0	23	2	2	0	700,00	600,00	0	600,00	100,00
12	94	21	0	0	6	6	0	2100,00	1800,00	0	1800,00	300,00
13	2	15	24	0	0	0	0	0	30,00	0	30,00	-30,00
14	54	15	0	0	3	3	0	1050,00	900,00	0	900,00	150,00
Total			66	43	54	53	1	18550,00	15990,00	50,00	16040,00	2510,00

Table 5

Simulation of the results from the implementation of monitors

Day	Random numbers	Stocks at the beginning of the period, pcs.	Placed orders, pcs.	Orders received, pcs.	Demand, pcs.	Sold, pcs.	Unsuccessful demand, pcs.	Sales proceeds, UAH	Expenses		Total costs, UAH	Profit, UAH
									for preparation of goods, UAH	due to deficit, UAH.		
1	38	20	0	0	4	4	0	5400,00	4800,00	0	4800,00	600,00
2	13	16	21	0	3	3	0	4050,00	3800,00	0	3800,00	250,00
3	34	13	0	0	4	4	0	5400,00	4800,00	0	4800,00	600,00
4	15	9	0	0	3	3	0	4050,00	3600,00	0	3600,00	450,00
5	25	6	0	21	3	3	0	4050,00	3600,00	0	3600,00	450,00
6	88	24	0	0	6	6	0	8100,00	7200,00	0	7200,00	900,00
7	95	18	0	0	7	7	0	9450,00	8400,00	0	8400,00	1050,00
8	99	11	23	0	7	7	0	9450,00	8600,00	0	8600,00	850,00
9	88	4	0	0	6	4	2	5400,00	4800,00	300,00	5100,00	300,00
10	71	0	0	0	4	0	4	0,00	0,00	600,00	600,00	-600,00
11	39	0	0	23	4	4	0	5400,00	4800,00	0	4800,00	600,00
12	21	19	0	0	3	3	0	4050,00	3600,00	0	3600,00	450,00
13	12	16	21	0	2	2	0	2700,00	2600,00	0	2600,00	100,00
14	58	14	0	0	4	4	0	5400,00	4800,00	0	4800,00	600,00
Total			63	42	60	54	6	72 900,00	65 400,00	900,00	66 300,00	6 600,00

Table 6

Simulation of the results from the implementation of printers

Day	Random numbers	Stocks at the beginning of the period, pcs.	Placed orders, pcs.	Orders received, pcs.	Demand, pcs.	Sold, pcs.	Unsuccessful demand, pcs.	Sales proceeds, UAH	Expenses			Profit, UAH
									for preparation of goods, UAH	due to deficit, UAH.	Total costs, UAH	
1	2	3	4	5	6	7	8	9	10	11	12	13
1	2	8	0	0	0	0	0	0,00	0,00	0	0,00	0,00
2	40	8	7	0	1	1	0	650,00	680,00	0	680,00	-30,00
3	43	7	0	0	1	1	0	650,00	580,00	0	580,00	70,00
4	54	6	0	0	2	2	0	1300,00	1160,00	0	1160,00	140,00
5	23	4	0	7	0	0	0	0,00	0,00	0	0,00	0,00
6	72	11	0	0	2	2	0	1300,00	1160,00	0	1160,00	140,00
7	75	9	0	0	2	2	0	1300,00	1160,00	0	1160,00	140,00
8	8	7	8	0	0	0	0	0,00	100,00	0	100,00	-100,00
9	71	7	0	0	2	2	0	1300,00	1160,00	0	1160,00	140,00
10	80	5	0	0	3	3	0	1950,00	1740,00	0	1740,00	210,00
11	50	2	0	8	1	1	0	650,00	580,00	0	580,00	70,00
12	96	10	0	0	4	4	0	2600,00	2320,00	0	2320,00	280,00
13	51	6	10	0	1	1	0	650,00	680,00	0	680,00	-30,00
14	72	5	0	0	2	2	0	1300,00	1160,00	0	1160,00	140,00
	Total		25	15	21	21	0	13 650,00	12 480,00	0	12 480,00	1 170,00

When organizing orders and deliveries according to the above scheme, a deficit and, therefore, unsatisfied demand can occur only when the daily demand reaches its maximum quantity within two or three days, which can rarely occur. The probable losses from such a low probability of deficit are not significant for this firm. An increase in the balance of components can lead to no less significant losses.

To automate the imitation of these processes, the operation of table. 4-6 are to be programmed in the Microsoft Excel application in the systemic relationship of these tables within a single program. In this program, random numbers must be set inside tables as a function built into the Microsoft Excel application. This allows you to change infinitely a set of random numbers by successive movements of the mouse cursor and thus observe the imitation of commercial processes and their results for all components in all tables of the simulation program in order to understand the behavior of the system and evaluate various strategies that ensure the functioning of this system.

Replacing any initial parameters in this program (product price, stocks, delivery times and volumes of orders, demand state, cost level) will automatically change the financial result, reflecting the predicted value, as well as losses from unsatisfied demand.

All tables presented in this model are calculated in "Excel" and can serve as an example of the design of a computer program performed in electronic tables. When programming, it is necessary that the costs in the Excel tables be entered in relation to the volume of sales and supplies.

List of references

1. Igor Pistunov. Useful examples optimal solution real financial and economic problems. Saarbrücken, Deutschland : LAP LAMBERT Academic Publishing , 2017. – 242 p.