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OPTIMIZATION OF THE TECHNOLOGICAL COST PRICE OF THE POWER EQUIPMENT DETAILS MANUFACTURE

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Бағдарламалық өнім өндірісмегі информацияны жинау, ауысу, сақтау, өндеу мәселелерін шешеді және өндірістік тиімді жоспарын анықтайды.

Программный продукт решает вопросы сбора, обмена, хранения, обработки информации на предприятии и нахождения оптимального плана производства.

The software decides questions of accumulation, exchange, storage, processing of the information at the enterprise and finding of the manufacture optimum plan.

The project was developed at the industrial repair enterprise of the Euroasian power corporation.

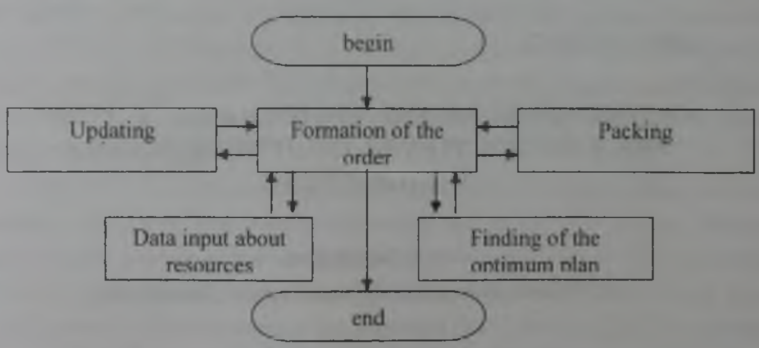
IRE EPC, engaged in repair of power devices, having been in process of information technologies introduction now. The enterprise has almost forty years repair experience, and there is always a necessity of the centralized management of data.

IRE EPC has manufacture of details organized. After realization of all repair work some resources remain unused. The research problem consists of a definition of volume, «most favourable» to the enterprise, of manufacture of products made from the stayed materials and norms of time.

The storage of the data about all orders, about details used in these orders, about warehouses are necessary, which contain the materials to order are fixed etc. The Integrated block diagram is submitted in a picture.1.

The technological cost price is calculated only. Certainly, the system productivity depends on such factors, as: available time of human labour, equipment and raw materials.

The general method of tasks decision in linear programming named after simplex - method is used in this project. The initial conditions are not known, because of the orders for details manufacture of the same type repeat seldom, that's why data input by the order from the keyboard therefore is organized. The resources restrictions nor are determined, owing to that fact, that they firstly go for the enterprise repair works, and then - for manufacture. The information on quantity of materials and electrodes in a warehouse, norm of time of works, which could be manipulated during manufacture, is kept in a residual database («Ostatok. dbf») after realization of all repair work.

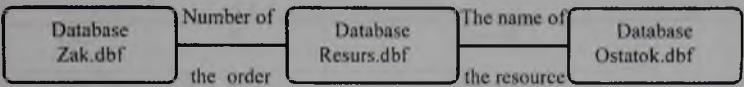


Picture 1

During a finding of the optimum plan of manufacture the data of the following bases are used: «Ostatok.dbf», «Resurs.dbf», «Zak.dbf».

The information on the order to be kept in «Zak.dbf» base, resources necessary for performance of the order - in «Resurs.dbf».

There are communications between bases:



Picture 2

Mathematical model can be written down as:

$$\max Z = F(X_1,...,X_n) \text{ (aim function)}$$

$$\text{with} \quad \left.\begin{array}{l} g_i(X_1,...,X_n) \le b_i \\ X_1,X_2,...,X_n \ge 0 \end{array}\right\} \text{ (restriction)}$$

Where i=1,2, ..., m.

Variable. Variable in model are the manufacture volumes of each type product.

Aim function. The specificity of the profit is that the more an enterprise enclose, the will more receive. The expenses are counted up, and certain percent comes back. Necessary to summarize of all resources cost to find cost of the order, the data is undertaken from «Resurs.dbf» base.

Restrictions. Expenses of each initial product for manufacture of all products should be less or equal of the greatest possible stock of the given resource, the information to be kept in «Ostatok.dbf» base. The demand of each type of a detail is less or equal to quantity in the order (base «Zak.dbf»).

For presentation of the program work solving a task by a simplex - method, let us put a condition with the concrete data.

For example, we enter the following: the name - grid, number of the order - 1, quantity - 300, customer - TPC-1, date - May 20 2000.

On manufacture of a grid there are the following resources:

Table 1.

Type	The name	Quantity/Norm of time	Cost
Materials	Wire	4	94
Work	Cargo handling	0,01	40
	Welding	0,2	12,71
	Sectoring	0,1	0,58
	Metalwork - assembly	0,13	10,36

Let's enter the data of the second order: the name - pocket of the pump, number of the order - 2, quantity -2, customer - TPC-1, date - May 22 2000.

On manufacture of the pump pocket there are following resources:

Table 2

Type	The name	Quantity/Norm of time	Cost
Materials	Sheet 6	799	28,8
	Sheet 8	36	28,8
	Sheet 10	2,4	28,8
	Sheet 16	33,4	27
	Circle 16 mm	3,4	35
	Sheet 32	45,46	28,8
	propan	0,6	17,59
	Oxygen	3,7	41,4
	Wire	14,5	94
	Carbonic acid	10	23
	Bolt 12x10	18	115
	Bolt 12X40	12	125
Elec trode	Electrode 3d4	6	32,91
Work	Cargo handling	0,91	40
	Drilling	0,1	7
	Assembly	0,8	12
	Metalwork	0,5	8

The difficulty of construction of mathematical model consists of identification variable both representation of the purpose and restrictions as mathematical functions of these variable. In our case we have the following.

Variable.

X23- volume of manufacture of a product such as a grid;

X24- volume of manufacture of a product such the pump pocket;

Aim function.

To find cost of the order, it is necessary to summarize of all resources cost the data is undertaken from «Resurs.dbf» base. The results: cost of a grid - 157 tenge, pocket of the pump - 693 tenge.

$$Z = 157 \cdot X23 + 693 \cdot X24$$

Restrictions. Expenses of each initial product for manufacture of all products should be less or equal of the greatest possible stock of a resource, the information to be stored in «Ostatok.dbf» base. The reserve is equal 1000 for all resources of this example. The demand of each type of a detail is less or equal to quantity in the order, the data is undertaken from «Zak.dbf» base. Demand for a grid -300, pocket of the pump -2.

So, the mathematical model can be written down as following:

To define volumes of products manufacture (X23, X24), at which

$$\max Z = 157 \cdot X23 + 693 \cdot X24$$

is achieved with

$$\begin{cases} 0{,}6 \cdot X24 \le 1000 \\ 6 \cdot X24 \le 1000 \\ 3{,}7 \cdot X24 \le 1000 \\ 36 \cdot X24 \le 1000 \\ 33{,}4 \cdot X24 \le 1000 \\ 45{,}46 \cdot X24 \le 1000 \\ 10 \cdot X24 \le 1000 \\ 4 \cdot X23 + 14{,}5 \cdot X24 \le 1000 \\ 18 \cdot X24 \le 1000 \\ 12 \cdot X24 \le 1000 \\ 799 \cdot X24 \le 1000 \\ 3{,}4 \cdot X24 \le 1000 \\ 2{,}4 \cdot X24 \le 1000 \\ 0{,}5 \cdot X24 \le 1000 \\ 0{,}1 \cdot X24 \le 1000 \\ 0{,}2 \cdot X23 \le 1000 \\ 0{,}13 \cdot X23 \le 1000 \\ 0{,}01 \cdot X23 + 0{,}91 \cdot X24 \le 1000 \\ 0{,}1 \cdot X23 \le 1000 \\ 0{,}8 \cdot X24 \le 1000 \\ X23 \le 300 \\ X24 \le 2 \end{cases}$$

If the user wishes to receive the greatest possible profit equal to certain percent of return from 39564,71 tenge, it is necessary to organize the grid manufacture in quantity - 245, pocket of the pump - 1.

The software is developed in Delphi.

So, it allows:

- to enter the data on the order from the keyboard. The opportunity of editing, addition, removal of records, cancellation of last change is stipulated;
- to form the list of necessary resources;
- to update used databases;
- to pack;
- to find the optimum plan of manufacture. The general method of the tasks decision in linear programming named by a simplex - method is used.

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