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AUTOMATED METHODS FOR SOLVING LINEAR PROGRAMMING PROBLEMS

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ANNOTATION
This article discusses the issues of using Simplexwin and Optimal 2 programs in solving linear programming problems

Keywords and Expressions: Simplexwin and Optimal 2 programs

INTRODUCTION

The basis for the implementation of any management task is the adoption of an optimal decision by a specific person. The optimal solution is considered to be such a solution that ensures the achievement of the goal in the conditions under consideration with the maximum effect. Among the set of optimization problems, there are special problems that are called linear programming problems. The first articles on linear programming were published in the USA only in 1949. In them, the American scientist J. Danzig presented his simplex method. In 1949, L.V. Kantorovich and M. K. Gavurin presented the method of potentials for solving the transport problem.

Consider the following problem, called the transportation problem. There are m suppliers $A_1, A_2, \dots, A_m$, who have stocks of the same cargo in the amount of $a_1, a_2, \dots, a_m$ units, respectively. This cargo needs to be delivered to n consumers $B_1, B_2, \dots, B_n$, who ordered $b_1, b_2, \dots, b_n$ units of this cargo, respectively. All tariffs for cargo transportation c_{ij} (the cost of transporting a unit of cargo) from supplier A_i to consumer B_j are also known. It is required to draw up such a transportation plan in which the total cost of all transportation would be minimal.

It is convenient to write the condition of the transport problem in the form of the following transport Table 1.

Table 1

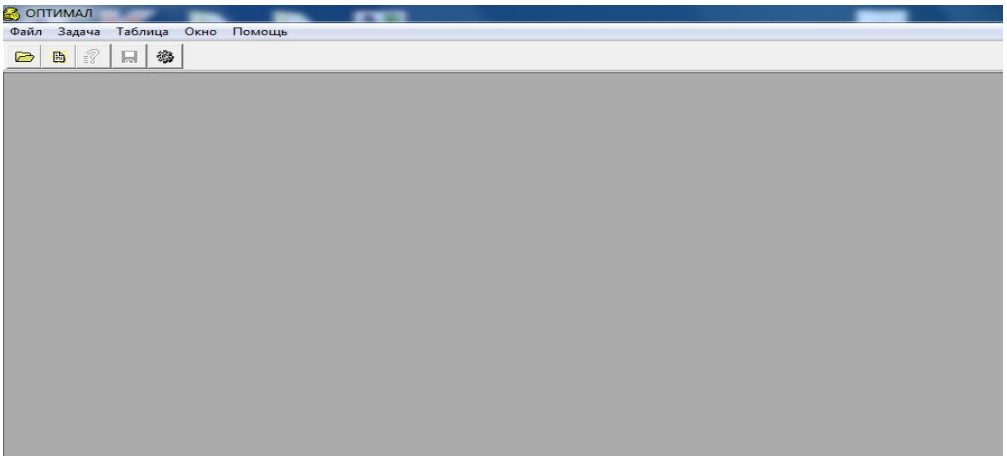
Reserves \ Orders		B_1	B_2	...	B_n
		b_1	b_2	...	b_n
A_1	a_1	c_{11}	c_{12}	...	c_{1n}
A_2	a_2	c_{21}	c_{22}	...	c_{2n}
...	...	...	...	...	...
A_m	a_m	c_{m1}	c_{m2}	...	c_{mn}

Let's designate the total stock of cargo from all suppliers by the symbol a, and the total need for cargo from all consumers - by the symbol b. Then

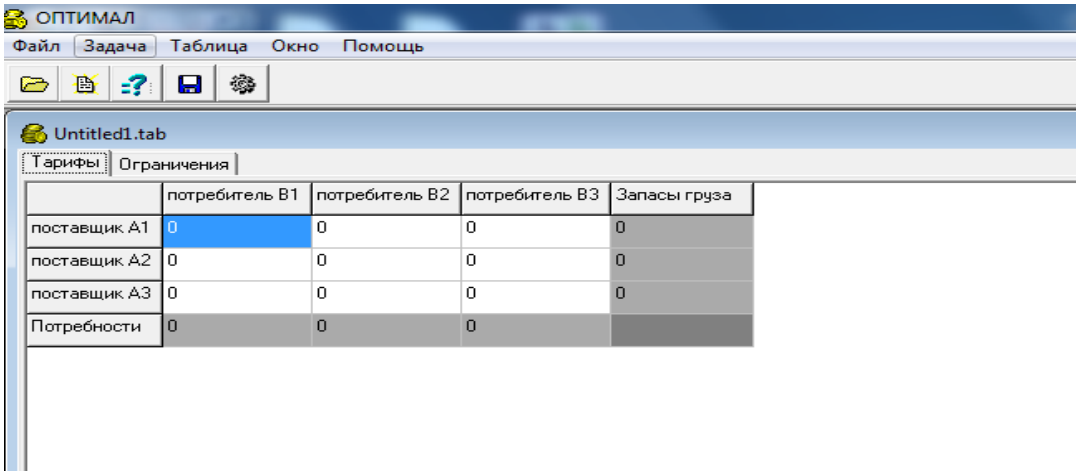
$$a = \sum_{i=1}^{m} a_i,$$

$$b = \sum_{j=1}^{n} b_j.$$

A transportation problem is called closed if $a = b$. If $a \neq b$, then the transport problem is called open.
Note that in the case of a closed task, all cargo stocks will be removed from suppliers, and all requests will be satisfied.
In the case of an open problem with $< b$, the entire cargo will be exported, but there will be under deliveries of the cargo to economically unprofitable consumers.
When $a > b$, on the contrary, all consumers will be satisfied, but part of the cargo will remain in the warehouses of economically unprofitable suppliers.
Currently, more convenient automated methods for solving linear programming problems have been developed, which save time for solving.
In work [1], an automated method for solving a transport problem using the "Optimal" program is considered. To solve the problems of optimal use of resources and diet, there is also an automated method, which is considered in [2].
It is known that linear programming problems are divided into 3 parts: the problem optimal use of resources, diet task and transport task. Below is the recommended method for solving the transport problem allows you to save time. One of these methods is the Optimal 2 program.
After starting the Optimal 2 program, the following window appears:



After selecting the "**Создать"** section the "**Файл**" menu, the following window appears:



In this window, the rows stand for suppliers A1, A2, A3, and the columns for consumers B1, B2, and B3. They form a 3x3 matrix. The last row and the last column show respectively the demand for the cargo and the stocks of the cargo.

The size of the matrix can be changed depending on the state of the task. To do this, select one of the "**Добавить строку"**, "**Добавить колонку"**, "**Удалить строку", "Удалить колонку"** sections in the "**Таблица"** menu. They are used to add row and column respectively and also to remove row and column.

Consider an example. Let it be required to solve the following transport problem of a closed type:

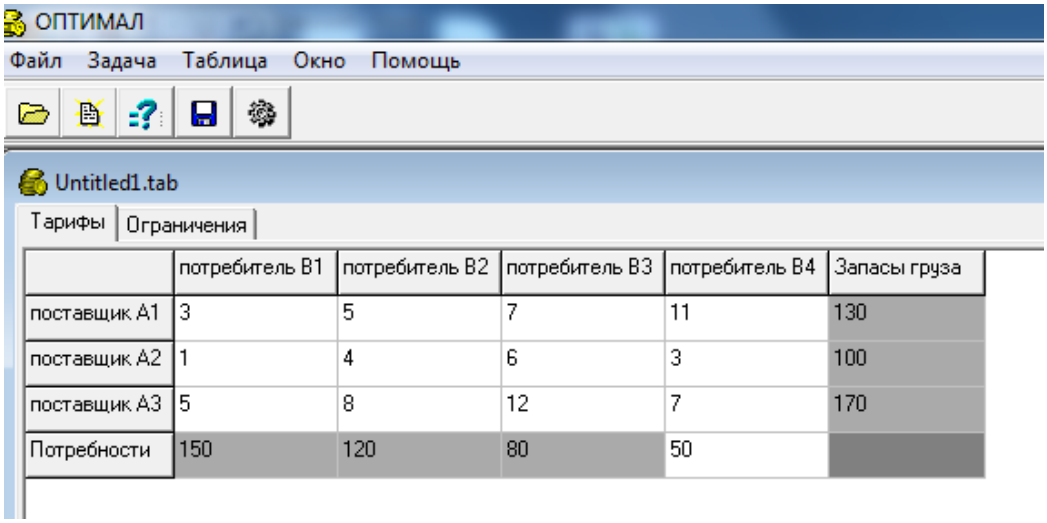
There are 3 suppliers A1, A2, A3, which have stocks of cargo in the amount of 130, 100, 170 units, respectively. This cargo needs to be delivered to four consumers B1, B2, B3, B4, who ordered 150, 120, 80, 50 units of this cargo, respectively. The cost of transportation is determined by the following matrix

$$C = \begin{pmatrix} 3 & 5 & 7 & 11 \\ 1 & 4 & 6 & 3 \\ 5 & 8 & 12 & 7 \end{pmatrix}$$

It is required to draw up such a transportation plan in which the total cost of all transportation would be minimal.

By the condition of the problem, the number of suppliers is $\boldsymbol{m = 3}$, and the number of consumers is $\boldsymbol{n = 4}$.

Select the "**Добавить колонку**" section in the "**Таблица"** menu and enter the data:



	потребитель B1	потребитель B2	потребитель B3	потребитель B4	Запасы груза
поставщик A1	3	5	7	11	130
поставщик A2	1	4	6	3	100
поставщик A3	5	8	12	7	170
Потребности	150	120	80	50	

Then we select the "**Решить задачу"** section in the "**Задача"** menu and at the 5th stage we will get the following solution.

Поставщик	Потребитель B1	B2	B3	B4	Запасы груза
A1	3 м	5 **50** м	7 **80** м	11 м	130
A2	1 **100** м	4 м	6 м	3 м	100
A3	5 **50** м	8 **70** м	12 м	7 **50** м	170
Потребность	150	120	80	50	

Целевая функция F= 2070

The following notation is adopted here:

i −row index

j − column index

m − number of suppliers

$n -$ number of consumers

x_{ij} −transportation between supplier A_i and consumer B_j

$M -$ some number close to infinity

The red color shows the bandwidth limitations of communications between suppliers and consumers. Transportation costs (tariffs) are displayed in gray.

Thus, for $X_{min} = \begin{pmatrix} 0 & 50 & 80 & 0 \\ 100 & 0 & 0 & 0 \\ 50 & 70 & 0 & 50 \end{pmatrix}$ the objective function F takes its minimum value, i.e. F=2070.

The solution has a matrix form, we can write it in the following form:

$x_{12} = 50,\ x_{13} = 80,\ x_{21} = 100,\ x_{31} = 50,\ x_{32} = 70,\ x_{34} = 50$

Thus, upon delivery of cargo from supplier A1 to consumer B2 in the amount of 50 units, from supplier A1 to consumer B3 in the amount of 80 units, from supplier A2 to consumer B1 in the amount of 100 units, from supplier A3 to consumer B2 in the amount of 70 units, from supplier A3 to consumer B4 in the amount of 50 units, the cost of transportation will be minimal.

The tasks of optimal use of resources and diet also have automated methods for solving. The Simplexwin program is one such method that saves time.

CONCLUSION

The transport problem belongs to linear programming problems, and it could be solved by the potential method or simplex method. But automated methods for solving linear programming problems make it possible instead of using potentials and volumetric simplex tables, use a more convenient method.

References

1. J.T.Beksultanov. Solution of the transport task using the “Optimal” program. https://www.elibrary.ru
2. V.Stepanov. Software implementation of a simplex method in Java. Higher mathematics. http://www.mathelp.spb.ru
3. Shukhratovich, Shirinov Feruzjon. "The Field of Computer Graphics and Its Importance, Role and Place in The Information Society." Texas Journal of Multidisciplinary Studies 4 (2022): 86-88.
4. Tokhirovna, Khakimova Yoqutkhon. "Stages Of Implementation Of Distance Learning In Higher Education." Texas Journal of Philology, Culture and History 1 (2021): 38-39.
5. Хонбобоев, Хакимжон Икромович, and Дилшод Улугбекович Султанов. "РУКОВОДСТВО НАУЧНО-ИССЛЕДОВАТЕЛЬСКОЙ ДЕЯТЕЛЬНОСТЬЮ СТУДЕНТОВ ПРИ ОБУЧЕНИИ ПРЕДМЕТАМ ИНФОРМАТИКИ И ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ." Актуальные научные исследования в современном мире 12-1 (2016): 63-65.
6. Хонбобоев, Хакимжон Октамович, Мубина Хакимжоновна Икромова, and Мухаммад-Анасхон Хакимжонович Икромов. "Ta’limda axborot texnologiyalarni qollashning oziga xos xususiyatlari." Молодой ученый 3-1 (2016): 21-22.
7. Хайдарова, Сапияхон. "Создание SQL-запросов в реляционных базах данных." Вестник РГГУ. Серия: Информатика. Информационная безопасность. Математика 3 (2020): 8-19
8. Muydinovich, R. I. "Problems and solutions of teaching in credit-module system in higher education institutions." The American Journal of Social Science and Education Innovations 3.04 (2021): 721-727.
9. Marufovich, Aripov Masud. "Encryption of the quran and forecasting events." ACADEMICIA: AN INTERNATIONAL MULTIDISCIPLINARY RESEARCH JOURNAL 11.2 (2021): 1021-1026.
10. Йулдошев, Уткир, and Уктамжон Жуманкузиев. "Определение ведущих педагогических закономерностей и основополагающих принципов формирования информационной культуры

детей школьного возраста." Общество и инновации 2.5/S (2021): 68-76.

11. Mamadjanova, S. V. "DESIGN FEATURES OF VIRTUAL LEARNING ENVIRONMENTS." European International Journal of Multidisciplinary Research and Management Studies 2.06 (2022): 1-5.
12. Toshpulatov, Raximjon I. "THEORETICAL FOUNDATIONS OF INFORMATION TECHNOLOGY." International Journal of Pedagogics 2.09 (2022): 53-57.
13. Juraev, M. M. (2022). Prospects for the development of professional training of students of professional educational institutions using electronic educational resources in the environment of digital transformation. Academicia Globe: Inderscience Research, 3(10), 158-162.
14. Shuxratovich, Shirinov Feruzjon, and Botirov Muzaffarjon Mansurovich. "PROBLEMS WORKING WITH COMPUTER GRAPHICS APPLICATIONS IN THE LEARNING PROCESS."
15. Normatov, R. N., M. M. Aripov, and I. M. Siddikov. "Analysis Method of Structural-complex System Indicators by Decomposition Into Subsystems." JournalNX 7.04 (2021): 68-71.
16. Muydinovich, Rasulov Inom. "The Role of Digital Technologies in Growing Secondary School Students to the Profession." Eurasian Scientific Herald 6 (2022): 137-142.
17. Marufovich, Aripov Masud, and Shirinov Feruzjon Shuxratovich. "BO ‘LAJAK INFORMATIKA FANI O ‘QITUVCHILARINING GRAFIK AXBOROTLAR BILAN ISHLASH KOMPETENSIYASINI RIVOJLANTIRISH." TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI 2.1 (2022): 183-187.
18. Shukurovich, Madrahimov Shuhratjon, and Madrahimova Mahfuza Ahmedovna. "Measures For Monitoring And Evaluation Of Power Activity In Higher Education." *JournalNX*: 423-426.
19. Madrakhimov, Shukhrat Shukurovich, and Mahfuza Akhmedovna Madrakhimova. "A HERO WHO SAW THE WAR!." *75-летию Победы Великого народа посвящается: Люди. События. Факты*. 2020.
20. Aripov M.M. Structural methods for program testing. Journal of Positive School Psychology. Vol.6, No 10, 2022, p.3428-3431.