Olga Ioana Amariei, Denis Fourmaux, Constantin Dumitrescu, Raul Malos

The Comparing Analysis between Network Modeling Module of Informatics Program WinQSB and Transportation Module of Informatics Program QM

In this paper, based on a unbalanced transportation problem, we make an comparing analysis between the modules of informatics programs WinQSB and QM, adequate solving this type of problems namely: Network Modelling module and Transportation module.

Keywords: *WinQSB program, QM program, graph, analysis, module*

1. Introduction.

Informatics product WinQSB, activates under Windows and is composed by 19 modules among others Network Modelling module, witch helps solving different kind of problems connected to Graph Theory, among others: transportation issue, minimal way in Graph, maximal or minimal way in Graph, allocation issues, outrider issue (Figure 1).
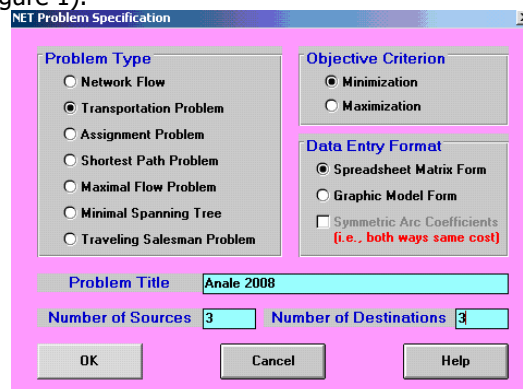

Figure 1. Dialog box from File menu in WinQSB program.

QM is composed from 17 modules (Figure 2) and rolls under operating system MS-DOS and Windows.
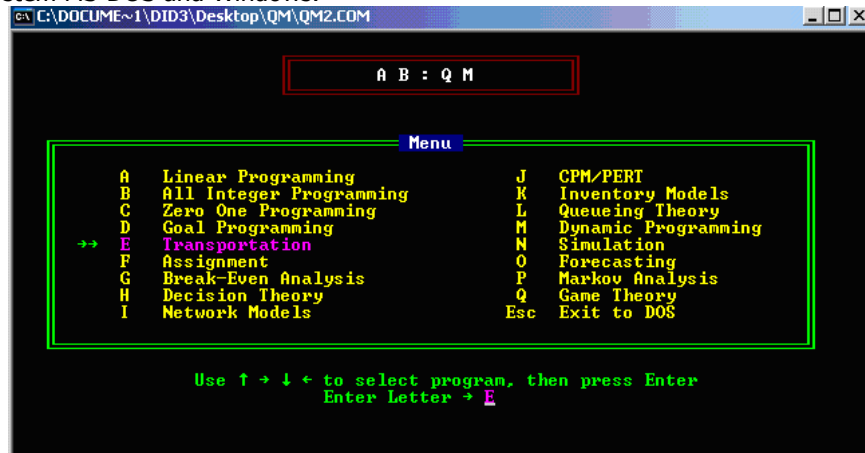

Figure 2. Showing the modules of QM program on screen

The objective of transportation issue is to determine the lower transportation total cost between a set of source nods and a set of destination nods, issue solved with the help of „Simplex" method.

2. The problem's data.

A company produces the same product in 3 different enterprises and it distribute in 3 regional deposits. The production capacity and the needs of those enterprises are given by Table 1. Fabrication costs for this product are identical in the three enterprises, the only relevant cost being the transportation cost between enterprises and deposits they are shown in Table 1, expressed in EURO.

Table 1.

To From	Deposit 1	Deposit 2	Deposit 3	Capacity (pieces)
Enterprise 1	5	4	3	100
Enterprise 2	8	4	3	300
Enterprise 3	9	7	5	200
Need (pieces)	300	200	200	

It is willing the determination of delivering way of the products from enterprises to deposits, in order to realize a minimization of transportation total cost, respecting the problems connected to production necessity of enterprises and the needs of deposits.

3. Introduction of information.

Introduction of the transportation issue data with WinQSB can be realized in two ways: matricidal and through graphic representation of a Graph.

The module assumes the introduction of the issue under matricidal form.

Figure 3. The main window of Network Modelling module, in witch data is introduced.

Figure 4.

In figure 4 we could see the title window of the screen for taking information (entering parameters) specific to Transportation module of informatics program QM.

It can be seen that the given problem is not balanced, because:

$$\sum_{i=1}^{3} a_i = 600 < \sum_{j=1}^{3} b_j = 700 \qquad (1)$$

37

In order to satisfy balance condition, it has to be introduced a fictive enterprises, with a capacity equal to 700-600=100 pieces and with aero unit costs of transportation, witch is automatic made by WinQSB.

4. Solving the transportation issue.

After data introduction, solving the problem is made by choosing one of the available options from Solve and Analyze menu, respectively:

- Solve the Problem – opens a new window with final results in matricidal form
- Select Initial Solution Method – offers the possibility of choosing a method for initial solution between the fallowing available (Figure 5).
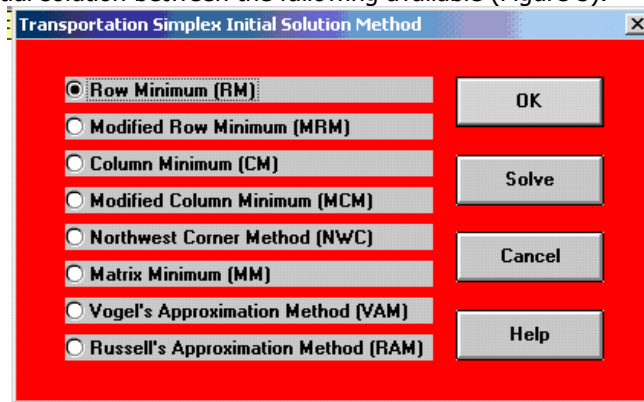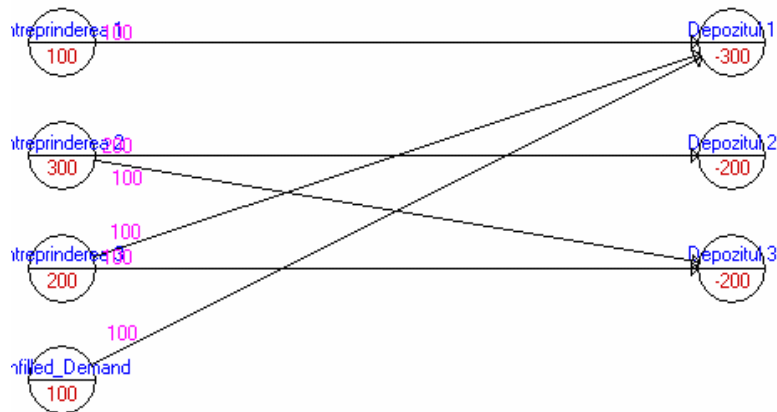

Figure 5.

Figure 6. The Graf of the problem, given by WinQSB program

- Solve and Display Steps-Network – visualizing the steps from solving the problem in graphic form
- Solve and Display Steps-Tableau – visualizing the steps from solving the problem in matricidal form.

By selecting "Solve the problem" option, it has been obtained the fallowing results (Figure 7) in witch appear the quantities to be transported between deposits, so that total transportation cost to be minimal.

07-31-2008	From	To	Shipment	Unit Cost	Total Cost	Reduced Cost
1	Intreprinderea 1	Depozitul 1	100	5	500	0
2	Intreprinderea 2	Depozitul 2	200	4	800	0
3	Intreprinderea 2	Depozitul 3	100	3	300	0
4	Intreprinderea 3	Depozitul 1	100	9	900	0
5	Intreprinderea 3	Depozitul 3	100	5	500	0
6	Unfilled_Demand	Depozitul 1	100	0	0	0
	Total	Objective	Function	Value =	3000	

Figure 7.

Total cost of transportation is minimum 3000 EUR if:
- Enterprise 1 supplies only Deposit 1 with 100 pieces from product
- Enterprise 2 supplies Deposit 2 with 200 pieces and Deposit 3 with 100 pieces
- Enterprise 3 supplies Deposit 1 with 100 pieces and Deposit 3 with 100 pieces
- The fictive enterprise covers the rest of the needs, respectively 100 pieces for deposit
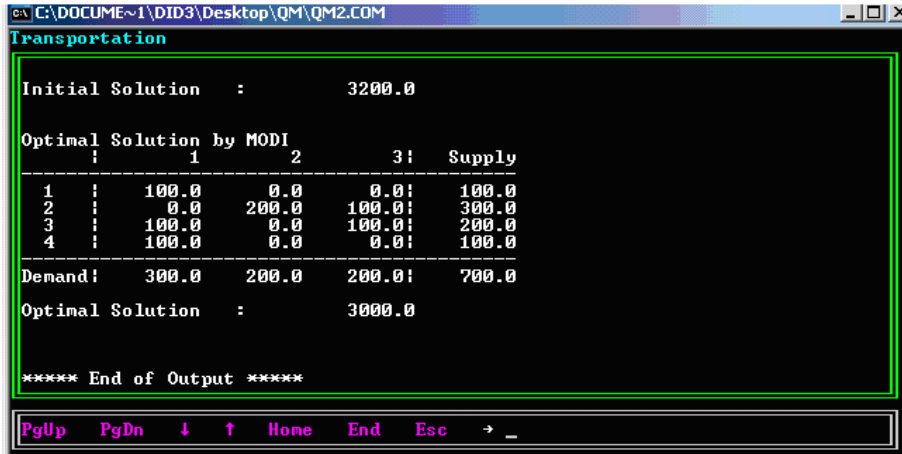

Figure 8. Initial solution

Figure 9. Optimal solution

In informatics program QM case, after introduction of parameters, in data window is shown the model of taking the entering data of the problem (figure 4), and then with Run, it is obtained the exit window (figures 8 and 9).

5. Analysis made with the help of WinQSB program.

Network Modelling module offers the possibility of making some „What-If" analysis or parametric analysis, by choosing "Perform What If Analysis" or " Perform Parametric Analysis" options from Solve and Analyze menu.

In example, if the transportation cost between Enterprise 3 and Deposit 3 grows, it became 7 EURO. Selecting option "Perform What-If Analysis" has the effect of opening a dialog window, in witch it will be specified the changing elements.

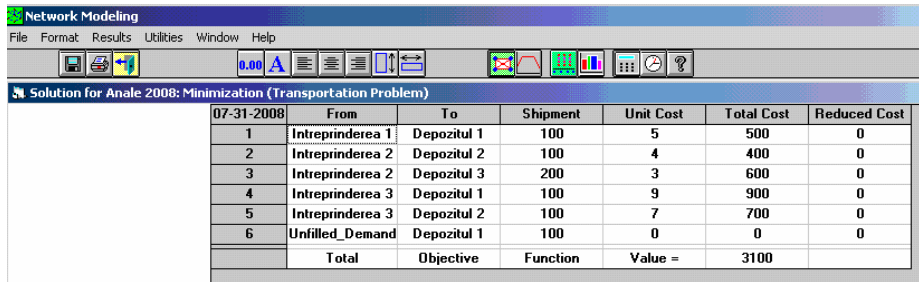| 07-31-2008	From	To	Shipment	Unit Cost	Total Cost	Reduced Cost
1	Intreprinderea 1	Depozitul 1	100	5	500	0
2	Intreprinderea 2	Depozitul 2	100	4	400	0
3	Intreprinderea 2	Depozitul 3	200	3	600	0
4	Intreprinderea 3	Depozitul 1	100	9	900	0
5	Intreprinderea 3	Depozitul 2	100	7	700	0
6	Unfilled_Demand	Depozitul 1	100	0	0	0
	Total	Objective	Function	Value =	3100	

Figure 10. The obtained results during the transportation cost modification

40

As a result of increasing the transportation cost between Enterprise 3 and Deposit 3, total cost of transportation will grow with 100 EUR, becoming 3100 EUR, and in the same time the quantity of transportation is changing (Figure 10) like this:

- Enterprise 1 still supplies only Deposit 1 with 100 pieces from product
- Enterprise 2 supplies Deposit 2 with 100 pieces and Deposit 3 with 200 pieces
- Enterprise 3 stops supplying Deposit 3, but supplies 200 pieces for Deposit 1 and 100 pieces for Deposit 2.
- The fictive enterprise still supplies Deposit 1 with 100 pieces.

07-31-2008	From	To	Shipment	Unit Cost	Total Cost	Reduced Cost
1	Intreprinderea 1	Depozitul 1	100	5	500	0
2	Intreprinderea 2	Depozitul 2	200	4	800	0
3	Intreprinderea 3	Depozitul 3	200	5	1000	0
4	Unfilled_Demand	Depozitul 1	200	0	0	0
	Total	Objective	Function	Value =	2300	

Figure 11.

If enterprise 2 has a production capacity for only 200 pieces, the obtained results during the modification of production capacity of Enterprise 2 are those shown in figure 11.

Total cost of transportation decreases to 2300 EUR, but Deposit 1 can not be supplied more then 100 pieces by Enterprise 1 and with 200 pieces by fictive enterprise. In the same time, Enterprise 2 supplies only Deposit 2, with 200 pieces, and the need for Deposit 3 is covered by Enterprise 3.

6. Conclusion

Both programs have given the same optimal solution.

Resolving steps of the transportation problem are alike. It selects the adequate module, and then the editing of the entering data is made by the keyboard (after "New" command) or from the disc (after "Load" command for an existing data file). Solving the problem, with QM program can be realized by "Run" command, and in WinQSB program can be made by choosing available options in "Solve and Analyze" menu. The results can be represented under matricidal form or graphic form (in WinQSB program) and only in matricidal form, for QM program.

WinQSB program offers the possibility of choosing a method for the initial solution, from the following solution: minimum on lines, minimum on modified lines, minimum on columns, minimum on modified columns, the method of N-V colt, minimum in matrix, Vogel approximation and Russell approximation, while the QM program offers only: the method of N-V colt, the method of minimal cost and the method of maximal differences (Vogel).

The QM program has Transportation module, destined only for solving transportation issue, while Network Modelling module helps solving many kind of problems in Graf theory.

The informatics program WinQSB, comparative with QM program under MS-DOS, offers among optimal solution, a series of analysis, like those shown previously.

References

[1]   Mihalca   R., http://www.biblioteca.ase.ro/catalog/rezultate.php?c=2&q=&st=s&tp1=1&tp2=1&tp3=1&tp4=1&tp5=1&tp6=1   Fabian   C. http://www.biblioteca.ase.ro/catalog/rezultate.php?c=2&q=&st=s&tp1=1&tp2=1&tp3=1&tp4=1&tp5=1&tp6=1 *Utilizarea produselor software: Word, Excel, PMT, WinQSB, Systat*; Editura ASE Bucuresti, 2003.

[2]   Blajina O.A. *Produse software aplicate in programarea matematica si teoria jocurilor*; Editura Albastra, Cluj-Napoca, 2006.

[3]   Habchi G. *Modelling and Simulation of Complex Production Systems. Editorial, Special Issue of SIMPRA, vol. 8, n° 5, December 2000. Guest Editor – Selected Papers from the 2nd French Conference on Modelling and SIMulation (MOSIM'99).*

Addresses:

- Asist. Eng. Olga Ioana Amariei, "Eftimie Murgu" University of Reşiţa, Piaţa Traian Vuia, nr. 1-4, 320085, Reşiţa, lepsiolga@uem.ro
- Conf. Dr. Denis Fourmaux, Universite d'Artois, IUT Bethune, 1230 Rue de l'Universite, 62408 Bethune Cedex, denis.fourmaux@univ-artois.fr
- Prof. Dr. Eng. Constantin Dan Dumitrescu, "Politehnica" University of Timisoara, Piaţa Victoriei, nr.2, 300006, dancdumitrescu2003@yahoo.com
- Prep. Ec. Raul Cezar Malos, "Eftimie Murgu" University of Reşiţa, Piaţa Traian Vuia, nr. 1-4, 320085, Reşiţa, raul_malos@yahoo.com