Available online at www.sciencedirect.com
ScienceDirect
Procedia Social and Behavioral Sciences 1 (2009) 2786–2790
Procedia
Social and Behavioral Sciences

World Conference on Educational Sciences 2009

WinQSB simulation software – a tool for professional development

Olga Ioana Amariei[a], Doina Frunzaverde[a], Gheorghe Popovici[a], Codruta Oana Hamat[a],*

[a]*Eftimie Murgu University, Piata Traian Vuia No. 1-4, 320085, Romania*

Received October 20, 2008; revised December 11, 2008; accepted January 02, 2009

Abstract

It is increasingly being applied by organizations to provide "soft" skills, not just technical training because technology can create realistic, interactive, computer-based simulations. The purpose of the paper is to present the way in which can be solved, using the WinQSB program, some types of problems. Sub modules as PERT/CPM and Facility Locations will be appealed, that is adequate solving the ordinance issues, respectively fabrications lines equilibration. Using this software in practice has a real contribution to the developed activities efficiency, insuring a high economy of time by eliminating routine activities tide to the classic way of solving the problem.

Keywords: simulation; optimizations; practice; module; WinQSB

1. Introduction

Most of the higher-education institutions today are grappling with issues associated with training their staff to enable them to make efficient use of new technologies in their teaching. The pressure for this comes from many sources including employers who are demanding graduates with generic as well as domain-specific skills, from students themselves who expect to be using technologies in their learning and from institutions that want to take advantage of the opportunities afforded by the new delivery methods.

The need for just-in-time training is becoming a critical element to organizational success, given the combination of fierce global competition, a commitment to lifelong learning, advances in technology, and a shortage of skilled labor. It's not surprising that the corporate e-learning market is one of the fastest growing sectors of the education industry. The growth of soft skills training is growing twice as fast a the IT/technical training market.

The package of informatics programs, Quantitative System for Business (WinQSB) is a software system realized by Y.I. Chang from Georgia Institute of Technology, functioning under Windows, being composed of 19 modules, each module being composed by others sub modules. Launching of a certain module allows to process the input

* Corresponding author. Tel.: +40-740-977-676; fax: +40-255-210-230.
E-mail address: lepsiolga@uem.ro.

doi:10.1016/j.sbspro.2009.01.494

data, obtaining the results, analysis and their interpretation. The extensions of the saved files are particular to each appealed module.

In the present paper will be appealed sub modules from PERT/CPM and Facility Location modules.

2. PERT/CPM

PERT/CPM module realize the ordinance of a project activities or operations using CPM (Critical Path Method) or PERT (Program Evaluation and Review Technique) methods of analyzing the critical way.

Starting with an ordinance issue example, it presents the way of using the module.

For example, in order to realize a new product an enterprise has to realize a project that contains 9 activities. (fig. 1), that have been noted with letters from A to I. The duration of the activities is given in weeks and are optimistic as time, probable and pessimistic, the cost being in thousand EUR.

Activity Number	Activity Name	Immediate Predecessor (list number/name, separated by ',')	Optimistic time (a)	Most likely time (m)	Pessimistic time (b)
1	A	-	2	3	4
2	B	A	2	4	10
3	C	A	2	2	2
4	D	B,C	4	6	12
5	E	C	2	5	8
6	F	C	2	3	8
7	G	E	3	7	10
8	H	E,F	3	5	9
9	I	D,G,H	5	8	18

Figure 1. Problem data

The results are presented under matricidal (figures 2) and graphic form (figure 3). For visual exemplification of results, the critical way is shown with red, where the activities A, C, E, G and I are critical and the duration of ending the project is 26 weeks.

07-11-2008 02:22:51	Activity Name	On Critical Path	Activity Mean Time	Earliest Start	Earliest Finish	Latest Start	Latest Finish	Slack (LS-ES)	Activity Time Distribution	Standard Deviation
1	A	Yes	3	0	3	0	3	0	3-Time estimate	0,3333
2	B	no	4,6667	3	7,6667	5,5	10,1667	2,5	3-Time estimate	1,3333
3	C	Yes	2	3	5	3	5	0	3-Time estimate	0
4	D	no	6,6667	7,6667	14,3333	10,1667	16,8333	2,5	3-Time estimate	1,3333
5	E	Yes	5	5	10	5	10	0	3-Time estimate	1
6	F	no	3,6667	5	8,6667	7,8333	11,5	2,8333	3-Time estimate	1
7	G	Yes	6,8333	10	16,8333	10	16,8333	0	3-Time estimate	1,1667
8	H	no	5,3333	10	15,3333	11,5	16,8333	1,5	3-Time estimate	1
9	I	Yes	9,1667	16,8333	26	16,8333	26	0	3-Time estimate	2,1667
	Project	Completion	Time	=	26	weeks				
	Number of	Critical	Path(s)	=	1					

Figure 2. Results under matricidal form

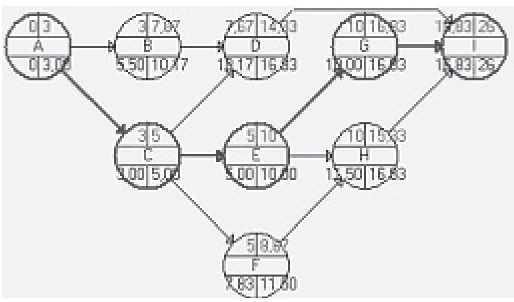

Figure 3. Results under graphic form

By opening the "Probability Analysis" window and applying a restriction that refers to project's duration, it can be observed that the probability of ending the project in 20 weeks is 1,25 %, and if it tries forcing to 23 weeks it obtains a percent of 13,12%. For ending the project in 26 weeks it's foresight a percent of 50%. After 1000 hours of simulation, it obtains the ending of the project in 26, 27 weeks. (fig. 4)

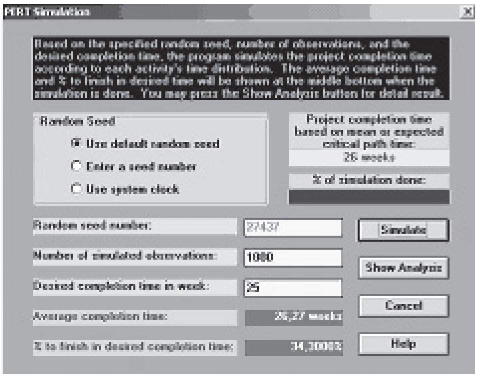

Figure 4. Results under graphic form

3. Facility Location

The equilibrating of fabrication lines assume the allocation of some activities on sequential work stations, based on previous relationship between activities. The objective is framing in time and demands of production using an minimum working stations.

Based also on an application it explains the appealing way of sun modules from Facility Location module.

An electronic pieces assembling workshop, has presently 6 working posts, marked with A - F and 10 activities. The controlling machine is automatic and can intervene in any time, starting with activity 2. The processing times are indicated in figure 5. Demanded productivity is 367 pieces / change; with a 20 minutes pause in the middle of morning and another one after the lunch. Determine the minimum number of working posts and calculate the efficacy of equilibration in assembling workshop.

Task Number	Task Name	Task Time in minute	Task Isolated (Y/N)	Immediate Successor (task number separated by ,)
1	Task 1	1.1	No	2,3,4
2	Task 2	0.4	No	5
3	Task 3	0.5	No	5
4	Task 4	1.2	No	6
5	Task 5	0.3	No	7
6	Task 6	0.4	No	8
7	Task 7	3.4	No	9
8	Task 8	0.8	No	9
9	Task 9	0.7	No	10
10	Task 10	0.3	No	

Figure 5. Problem data

WinQSB offers three kind of solutions in order to solve this problem: Heuristics; optimizing method "Best-Bud" search; Random generating - COMSOAL (COmputer Method of Sequencing Operations for Assembly Lines).

Solving the problem with COMSOAL generates a random number of solutions and pick up the best of these. The procedure ends if the optimal solution is found. The solution can be presented into a synthetic or detailed form, and the optimal way of placing the assembling line is presented graphically, as we can see in figure 6.

We can observe that the optimal solution assume 7 working stations in witch the 10 activities will be allocated as in figure bellow. The available time for a cycle is 10,8 minutes, witch from 9,10 minutes represents the duration of activities. The efficacy of assembling line equilibration, in this case is:

$$E_{fe}= \frac{\sum t_n}{t} \times 100 = \frac{9.1}{1.2 \times 9} \times 100 = 84.2\% \quad (1)$$

It tries solving with the problem with the heuristically techniques, and then it compares the variants obtained and establish the optimal variant. It will be specified a base method - “Shortest Task Time”, and an alternative one - “Random”, from those available.

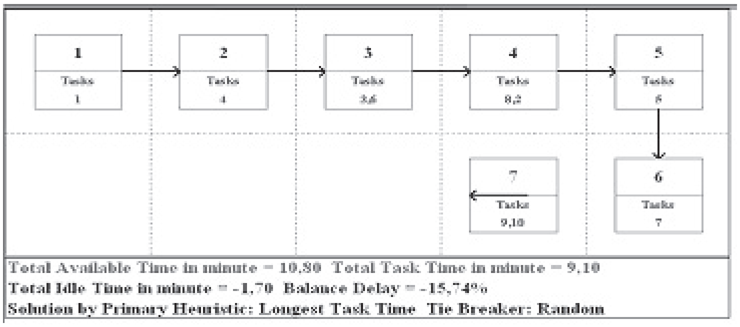

Figure 6. The way of placing the stations according to COMSOAL

The results under tabling form are presented in figure 7. In figure 8 can be observed the repartition of the 10 activities, using 6 working stations, and the available time for cycle is 9,6 minutes, which from 9,10 minutes represents the activity’s duration. The efficacy of assembling line equilibration, in this case is :

$$E_{fe}= \frac{\sum t_n}{t_{cn}} \times 100 = \frac{9.1}{1.2 \times 8} \times 100 = 94.8\% \quad (2)$$

07-03-2008 13:09:48	Line Station	Number of Operators	Task Assigned	Task Name	Task Time	Time Unassigned	% Idleness
1	1	1	1	Task 1	1,10	0,10	8,33%
2	2	1	2	Task 2	0,40	0,80	66,67%
3			3	Task 3	0,50	0,30	25,00%
4			5	Task 5	0,30	5,960464E-08	0,00%
5	3	1	4	Task 4	1,20	0	0,00%
6	4	1	6	Task 6	0,40	0,80	66,67%
7			8	Task 8	0,80	5,960464E-08	0,00%
8	5	3	7	Task 7	3,40	0,20	5,56%
9	6	1	9	Task 9	0,70	0,50	41,67%
10			10	Task 10	0,30	0,20	16,67%
	Solved by	Heuristic	Method				

Figure 7. The table with detailed results of the problem.

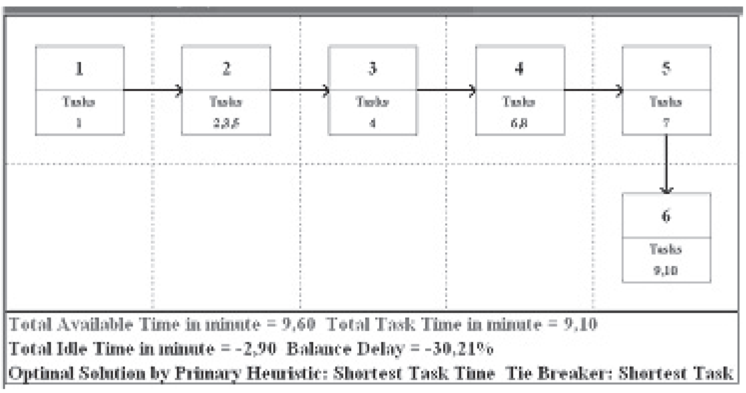

Figure 8. Results under graphic form

Analyzing the optimal variants offered by simulating program WinQSB, using in solving this problem two alternative solutions, it can be observed that the ideal solution is given by heuristically techniques.

All 10 activities are made on 6 working stations, not 7, as in COMSOAL, and the available time for a cycle is 9,6 minutes, not 10,8, witch from 9,10 minutes represents the duration of the activities.

Regarding the efficacy of assembling line it can be observed that in COMSOAL case, it is smaller with almost 11%, then in heuristically methods.

Today, the most effective simulation software for teaching soft skills share the same components of a best-selling video game. The user becomes immersed in the situation and reacts much as he or she would in real life. Simulation leads to learning by doing, still the most effective method. Unlike classroom training, technology-based learning offers consistency of training methodology and content, and the ability to track user participation and success.

5. Conclusion

More and more organizations are embracing the principles of Total Quality, Continuous Improvement, World Class, Best Practice and other business improvement strategies to enhance quality and service and reduce costs to remain competitive. Typically, these strategies place a higher or renewed emphasis on people or "soft" skills than more traditional command and control management practices. Some organizations fear that self-directed, technology-based training reduces group interaction, the ability to brainstorm and build on each other's ideas and enthusiasm. These face-to-face encounters are essential to creating and maintaining an organization's unique culture and help employees gain a better understanding of how things really get done in their organizations.

Using simulation software, development costs are also reduced, as are travel and employee time away from the office. By offering realistic interactive simulations in the privacy of their own home or workspace, employees can practice without fear of embarrassing themselves or offending others, and immediately see the impact of a response in a given situation.

There are much sustainers of simulation, from software companies as much as from companies that uses those programs. These companies sustain as well, the necessity of a well education and training that can assure the efficient using of the simulation. Understanding concepts as data collecting, model development, validation and experimentation is considered to be essential.

These are valid concerns and should be addressed as part of an organization's overall training and development strategy. With the increase in self-directed learning, an organization needs to consider how to facilitate interaction and communication in different ways.

References

1. Applied Management Science: A Computer-Integrated Approach for Decision Making, Author: John A. Lawrence, Jr. and Barry A. Pasternack Publisher: Wiley, 1998, ISBN: 0-471-13776-6
2. Y i h-L o n g C h a n g, K i r a n D e s a l. WinQSB, Version 2.0. ISBN: 0-471-40672-4, Wiley, 2002.
3. Amariei, O.I, Dumitrescu, C.D., Gillich, N., Hamat, C., Maloş, R.C., Optimizing a manufacturing system after analysis of ExtendTM and WinQSB simulation environment, 2008 IEEE International Conference Automation, Quality and Testing Robotics, THETA 16th edition, ISBN 978-973-713-248-2, Cluj-Napoca, Romania, May 22-25 2008.
4.Hamat, C., Amariei, O.I, Dumitrescu, C.D., Analysis of the quality control problems using the WinQSB software product, The 19th International DAAAM Symposium , Trnava, Slovakia, 22-25th October 2008.
5. Mihalca, R; Fabian, C (2003). Using the software products - Word, Excel, PMT, WinQSB, Systat , Editura ASE, Bucuresti.
6. Amariei, O.I, Fourmaux, D. Using the software product WinQSB in Critical Path Analysis, Analele Universităţii Eftimie Murgu din Reşiţa, 2008, ISSN 1453-7394