

CIV E 606
DESIGN AND ANALYSIS OF CONSTRUCTION OPERATIONS
ASSIGNMENT FOUR

Due Date: Tuesday, March 8th 2016 at 9:30 AM (in class)

QUESTION ONE

In a quarry, trucks deliver ore from three shovels to a crusher. A truck always returns to its assigned shovel after dumping a load at the crusher. There are two different truck sizes in use, 20-ton and 50-ton. The size of the truck affects its loading time at the shovel, travel time to the crusher, dumping and return trip time from the crusher back to the appropriate shovel. The durations for these activities for each truck size are summarized in Table 1.0.

Table 2.0: Activity Durations for the Quarry Operation

Activity	Small Trucks (20-ton)	Large Trucks (50-ton)
Loading at Shovel	Beta(0.6,0.95,1.5,4.7)	Uniform(4.0,8.3)
Travel to Crusher	Triangular(2.5,8.9,6.3)	Beta(0.3,1.3,5.7,12.4)
Dumping	Uniform(1.2,2.4)	Uniform(2.3,3.1)
Return to Shovel	Uniform(3.3,7.8)	Gamma(5.0,1.0)

The operation is setup in such a way that each shovel serves *two* 20-ton trucks and *one* 50-ton truck. Trucks are served at the shovels on a first-in, first-out basis. However, at the crusher larger trucks are given a higher priority over small trucks while trucks of the same size are served on a first-in, first-out basis.

Create a simulation model for the operation described using Simphony.NET GPT. Run the model for *600 time units* and answer the following questions:

- i. Determine the utilization and queue length associated with the shovels and crusher.
- ii. Which of the truck sizes is more productive at the end of the stipulated duration?
- iii. What is the average cycle length for small and large trucks?

QUESTION TWO

To introduce the contract bidding or negotiation process at a construction company, consider the schematic diagram in Figure 1.0. The process begins with an initial client contact, which, in this case, is an oil company requesting a bid on the construction of gasoline plant. The firm initiates a preliminary study of the proposed project which involves the initial reports to the marketing vice-president and to the president sequentially. Current policy is to perform a preliminary analysis (first internal study) for a project, which consists of five parallel studies: engineering, production, financial, marketing, and purchasing reports. If any of the reports is negative, the project is not negotiated further, and the process terminates and the costs of studies are considered as sunk costs. Each initial report has a 10% chance of recommending against a contract and a 90% chance of initial approval.

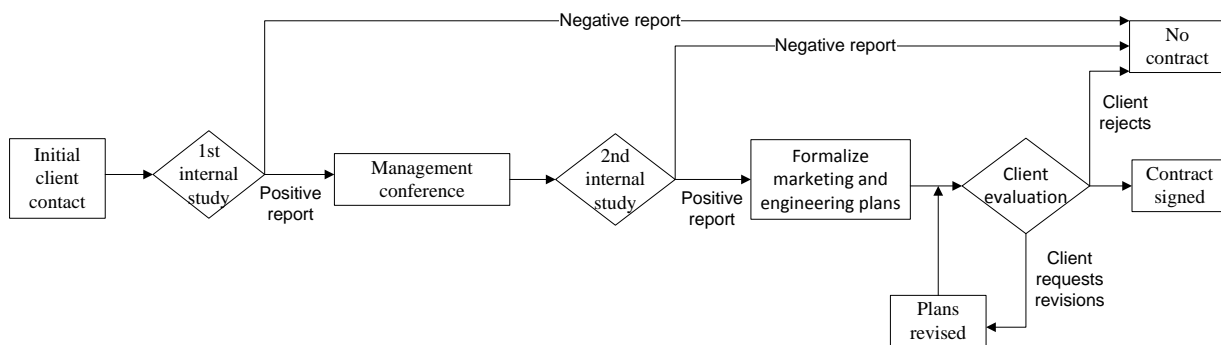


Figure 1.0: Process Logic for Evaluating and Approving Contracts at the Construction Firm

If, however, all the reports are positive, a management conference is held and second internal studies ensue. In this detail study, further information is sought of sales information and engineering information. If no negative recommendations are made as a result of the detailed studies (90% chance of approval for sales info and 80% chance of approval for engineering info), marketing and engineering plans are finalized, and the client is presented with a detailed project proposal. In the negotiation conference with the buyer, the client may reject the bid, accept it, or request revisions. Acceptance or rejection completes the contract negotiation process. Any stated revisions are incorporated into the proposal; the modifications are performed and then the client evaluation process is repeated until either acceptance or rejection is obtained.

Each activity describes above involves time and money, and each has an impact on the total effectiveness and success of the construction firm. The duration and cost for each activity is shown in Table 2.0

Table 2.0: Activity Costs and Durations

Activity	Duration (hours)	Fixed cost(\$)	Variable cost (\$/hr)
Initial client contact	Triangular(1,4,2)	0	10
Initial reports to the marketing vice-president	Triangular (5,25,10)	0	30
Initial reports to the president	Triangular (5,35,25)	0	50

Activity	Duration (hours)	Fixed cost(\$)	Variable cost (\$/hr)
Engineering report	Triangular (16,40,24)	200	20
Production report	Triangular (8,40,24)	100	10
Financial report	Triangular (10,26,16)	60	20
Marketing report	Triangular (8,40,24)	50	10
Purchasing report	Triangular (16,40,24)	60	17
Management conference	8	700	0
Sales information	16	400	30
Engineering information	16	400	35
Formalize Marketing and Engineering plans	Triangular (40,160,80)	800	25
Negotiation conference	Triangular (2,16,6)	500	0
Revisions and modifications	Triangular (20,80,40)	600	20

Develop a simulation model using Symphony.NET GPT modeling elements that will investigate 1,000 *bidding* opportunities of similar kind to answer the following questions:

- How much time and money does it take to obtain a successful contract?
- How much time and money is spent in bidding for contracts that are lost?
- What is the probability of winning and losing a contract?
- How much time and money are spent in the first phase of the bidding process (after finishing the first internal study)?

NOTES:

- This is an individual assignment and should be handled as such when attempting and submitting it. Cases of plagiarism in submissions will be handled according to University regulations.
- Please use the latest build of Symphony.NET from the website for modeling purposes in this assignment.
- Zip softcopies of all your models and email them to steve.hague@ualberta.ca and rekyalimpa@ualberta.ca before the assignment deadline. The file name should be your full names.
- Hard copies of your assignments should be submitted in class before the commencement of the lecture.