

**OPRE 6398 Prescriptive Analytics
Homework 8**

**Due 04/21/19
(3:00 p.m.)**

Note: 1. Your homework submission must be typewritten.

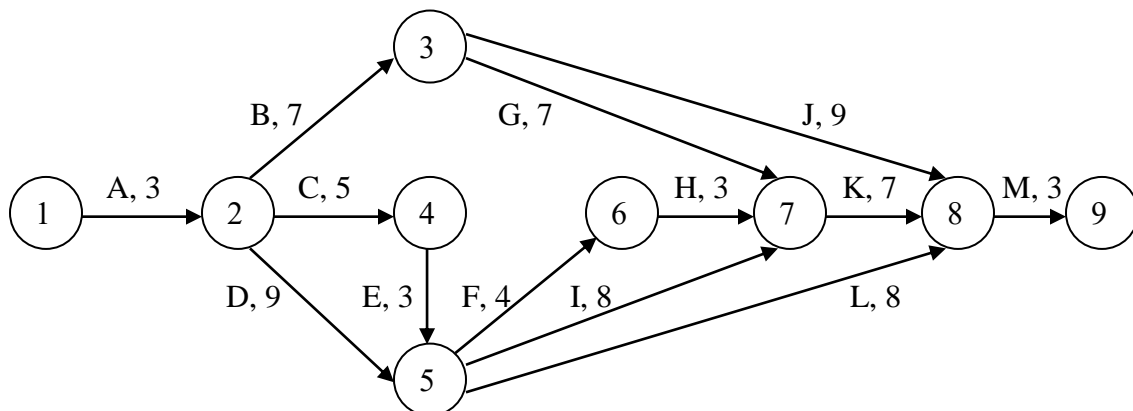
2. be sure to show detail calculations to earn full credit.

1. Read Readings 15 and 16.

2. The following table summarizes relevant information about the major activities involved in the project of constructing a new laboratory.

Activity	Immediate predecessor	Estimated time (weeks)
A: Form and pour concrete footings	None	3
B: Install turbine test drives	A	7
C: Erect wall	A	5
D: Construct electrical test rooms and equipment mounting facilities	A	9
E: Erect roof	C	3
F: Wire and Plumb	D, E	4
G: Install exhaust ducts, etc.	B	7
H: Install fixtures	F	3
I: Spray interior with fireproof chemical and let dry	D, E	8
J: Prepare for operation, tune up, and adjust drive units	B	9
K: Install insulation and interior walls	G, H, I	7
L: Install electrical test equipment	D, E	8
M: Finish interior with fireproof paint	J, K, L	3

A PERT network for the problem is presented below:



Use the enumeration method to analyze the network and answer the following questions:

- (1) What is the critical path?
- (2) What are the critical activities?
- (3) How long will it take to complete the entire project?

- (4) What is the slack for each of the noncritical paths?
- (5) If activity I (5-7) is late by one week, will it lengthen the project duration? Why or why not?
- (6) If activity L (5-8) is late by five weeks, will it lengthen the project duration? Why or why not?
3. Refer to the PERT network constructed in Example 15.2 of the Lecture Notes on Chapter 15. Apply the computational algorithm to determine the critical activities, the critical path, and the project duration. Be sure to show both the network and the “houses.”
4. Refer to the PERT network in Example 15.4 of the Lecture Notes on Chapter 15.
- (1) Develop a linear programming model for determining the project duration. It is not necessary to present the LP in standard form here.
- (2) Run Solver to solve the LP in (1). Be sure to copy and paste the Answer report at the appropriate place in your homework submission.
- (2) Is the computer solution in (2) above consistent with the manual solution based on the computational algorithm in Solutions to Example 15.4?
5. The credit card manager of a commercial bank must approve or reject applications for the bank's credit card. She currently uses a "scoring" procedure whereby a series of characteristics stated on an individual's application are weighted by predetermined numerical weights. Based on the total weighted score, an applicant is classified either "Good" or "Bad" according to whether the score exceeds or falls below the predetermined cutoff score. A credit card is issued only to a “Good” applicant.

Recently, the manager has been considering an alternative procedure whereby an applicant would be rejected if the score falls below a new "low cutoff" score (i.e., “Very Bad”), accepted if the score falls above a new "high cutoff" score (i.e., “Very Good”), and investigated further if it falls in between. "Further investigation" involves an extensive credit investigation at a cost of \$50 each and it will clearly indicate if the applicant is “Good” or “Bad.” Available data are presented below, where the first table summarizes the actual results from 1,000 applicants under the current system and what shown in the second table are the estimated results under the proposed system.

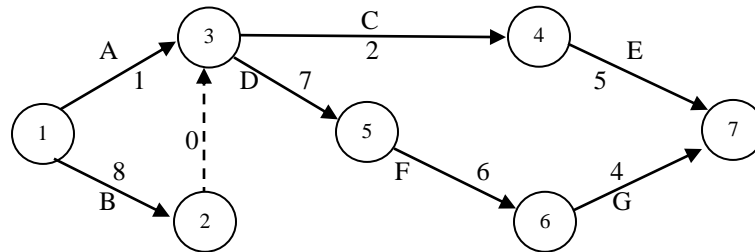
	Pays	Does not pay	Total
Good	450	150	600
Bad	*	*	400
Total	*	*	1,000
	Pays	Does not pay	Total
Very good	360	40	400
Good	168	72	240
Bad	*	*	60
Very bad	*	*	300
Total	*	*	1,000

* Cannot determine the payment performance of those applicants whose applications were rejected.

The bank has determined that the net present value of future profit for an applicant who pays is \$600, and the loss incurred by an applicant who does not pay is \$250. Perform a decision tree analysis to determine which

system should be used and what the maximum net profit per applicant will be. Be sure to include a copy of the computer printout. (Hint: This is similar to the problem in Example 14.11.)

6. The PERT network for a subcontracting project is shown below, where the activity times are in weeks:

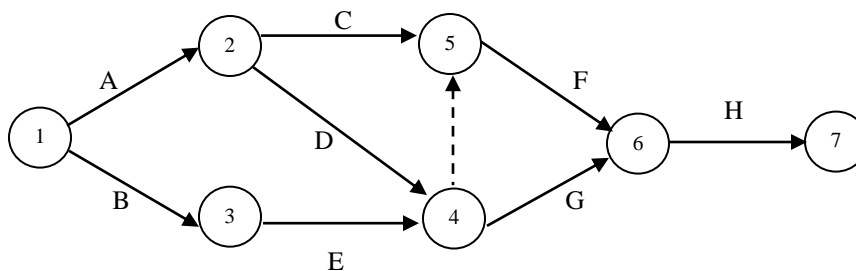


Use the enumeration method to solve the problem by answering the following questions:

- (1) What are the critical path and the critical activities?
 - (2) How long will it take to complete the entire project?
7. The activities involved in a purchasing project to be undertaken are:

Activity	Time (weeks)			IPs
	a	m	b	
A	1	3	5	-
B	1	2	3	-
C	1	2	3	A
D	2	3	4	A
E	3	4	11	B
F	3	4	5	C, D, E
G	1	4	6	D, E
H	2	4	5	F, G

The probabilistic PERT network without activity times for the project is shown below:



- (1) Prepare a table similar to the one in Solutions to Example 15.6, where key information about the activities and the paths is summarized.
- (2) Use the Z tables at the end of Lecture Notes on Chapter 15 to determine the probability that the entire project will be completed within 16 weeks.