THE LEBANESE AMERICAN UNIVERSITY
Project Management
INE 427 - Fall 2003

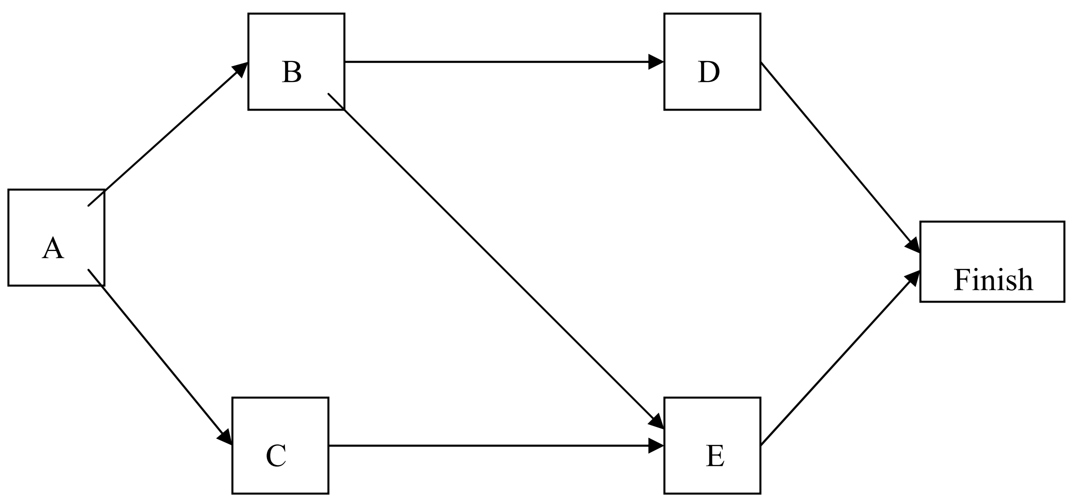
MIDTERM EXAM

NAME:________________________________ SCORE:___________

This is a 75 min closed book exam.

Problem 1: (25%)

The P-H Microship Co. needs to undertake a major maintenance and renovation program to overhaul and modernize its facilities for wafer fabrication. The company's president is planning the schedule for this project and has identified five major activities that will need to be performed according to the following project network.



He also has gathered the following data about the normal point and crash point for each of these activities.

Activity	Normal Time (weeks)	Crash Time (weeks)	Normal Cost (x1000)	Crash Cost (x1000)
A	3	2	54	60
B	4	3	62	65
C	5	2	66	70
D	3	1	40	43
E	4	2	75	80

These costs reflect the company's direct cost for the material, equipment, and direct labor required to perform the activities. In addition, the company incurs indirect project costs such as supervision and other customary overhead costs, interest charges for capital tied up and so forth. Indirect costs run at $5000 per month. He wants to minimize the overall **cost of the project**. Therefore, to save some of these indirect costs, he concludes that he should shorten the project by doing some crashing to the extent that crashing cost for each additional week saved is less than $5000.

a) To prepare for analyzing the effect of crashing, find the earliest times, latest times, and total float for each activity when they are done at Normal times. Identify the corresponding critical path and project duration.
b) Use time-cost tradeoff analysis to determine which activities should be crashed and by how much to **minimize the overall cost** of project. Under this plan, what is the duration and cost of each activity? How much money is saved by doing this crashing?

Problem 2: **(20%)**

For the problem data presented in problem 1, use a linear programming approach to answer question b). Formulate the problem and show the steps you would use in deriving the solution that minimizes overall project costs.

<u>Problem 3:</u> (25%)

The president of Log Construction Company is considering placing a bid on a building project. She determined that five tasks would need to be performed to carry out the project. Using the Pert three-estimate approach, she has obtained the estimates in the table below for how long these tasks will take. Also shown are the precedence relationships for these tasks.

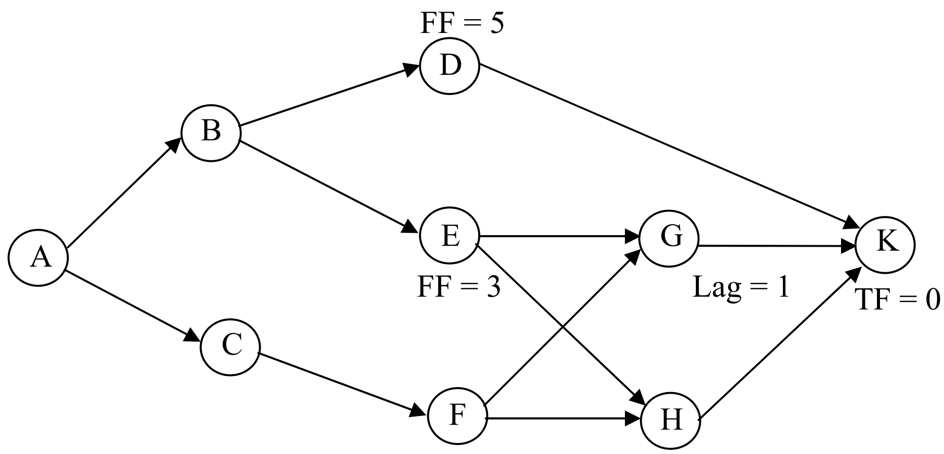
Task	Time Required			Immediate Predecessors
	Optimistic estimate	Most likely estimate	Pessimistic estimate	
A	3 weeks	4 weeks	5 weeks	_
B	2 weeks	2 weeks	2 weeks	A
C	3 weeks	5 weeks	6 weeks	B
D	1 week	3 weeks	5 weeks	A
E	2 weeks	3 weeks	5 weeks	B, D

There is a penalty of $500,000 if the project is not completed in 11 weeks. Therefore President is very interested in how likely it is that his company could finish the project in time.

a) Construct the project network for this project
b) Find the estimate of the mean and variance of the duration of each activity
c) Find the mean and the most likely Pert critical path
d) Find the approximate probability of completing the project within 11 weeks
e) The president has concluded that the bid she would need to make to have a realistic chance of winning the contract would earn Log Construction a profit of about $250,000 if the project completed within 11 weeks. However because of the penalty for missing this deadline, her company would lose about $250,000 if the project takes more than 11 weeks. Therefore, she wants to place the bid only if she has at least a 50% chance of meeting the deadline. How would you advise her?

<u>Problem 4:</u> (20%)

For the precedence network shown below determine the missing link lags and the four floats for each activity. Identify the critical path. Also, write the equations for computing activity floats based on link lags.



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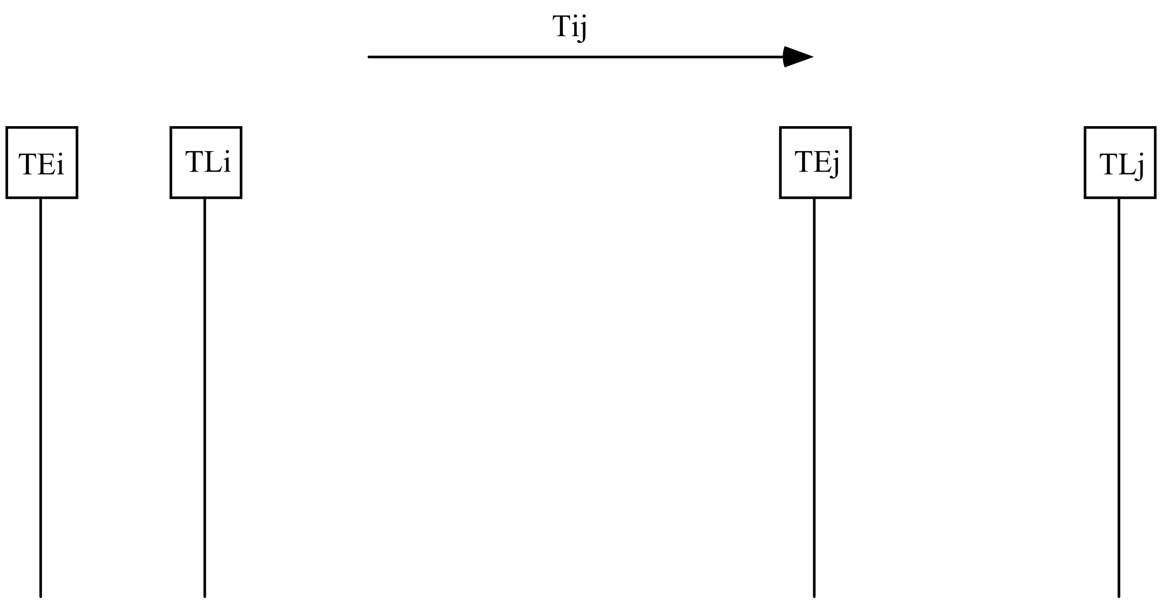
<u>Problem 5:</u> (10%)

The four vertical lines in the figure below indicate the early and late times for events i and j. (It is assumed that the time scale extends from left to right across the page.)

Complete this figure to show early and late start and finish dates for activity (i,j). Also show graphically and in an equation form all the various floats that can occur in a network. The length of the arrow for activity (i,j) equals its duration (i.e., in drawing do not assume that it is longer or shorter than shown).



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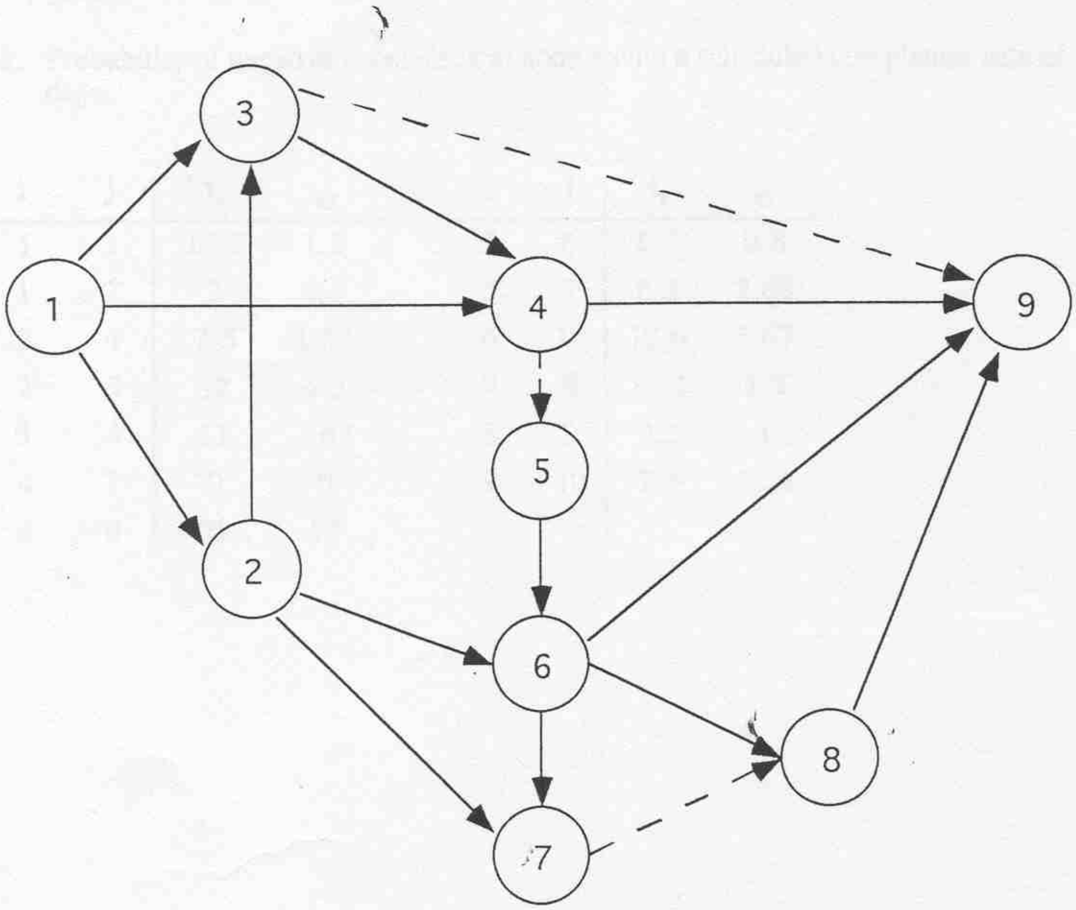
Midterm EXAM

NAME:______________________ SCORE:__________

This is a 60 min. closed book exam.

Problem 1: (15%)

Assume that the logic of the following network is correct. Locate and correct any diagramming errors. Redraw the arrow diagram in its correct form.



Problem 2: (35%)

Data for a simplified PERT network are given below. Each activity is listed by its start node, i, and end node, j, and their expected duration t_e (in weeks) and standard deviation σ. In addition TE_1 is zero and TE_{10} is 45. Also the variance of the project duration is 3.17. All times are in days.

a. Draw the PERT network.

b. Determine the mean and the standard deviation of Activity 4-8.

c. Determine the range of the early project finish which meets a probability range of 16 to 84%.

d. Probability of negative event slack at node 4 with a scheduled completion date of 40 days.

i	j	t_e	σ
1	3	10.5	1.5
1	2	2	0.5
2	4	7.5	1.33
2	5	12	4.5
3	4	11	1.67
4	7	0	0
4	8	??	??

i	j	t_e	σ
5	6	8.7	0.8
5	7	6.3	2.68
6	10	12.6	1.67
7	9	10.2	1.5
8	9	9.2	1
9	10	7.3	1.33

Problem 3: (15%)

Two rows of a table for the computation of an Activity on Arrow network are given below with some values missing. **Events 6 and 12 are critical**. Fill in the remaining values on each of the two rows. (Hint: A graphical solution and finding early and late event times of the nodes will be helpful).

I	j	ACT	T	ESD	EFD	LSD	LFD	TF	FF	INTF	INDF
6	8	A	7		20						
:	:	:	:								
:	:	:	:								
8	12	B	10				40		6		3

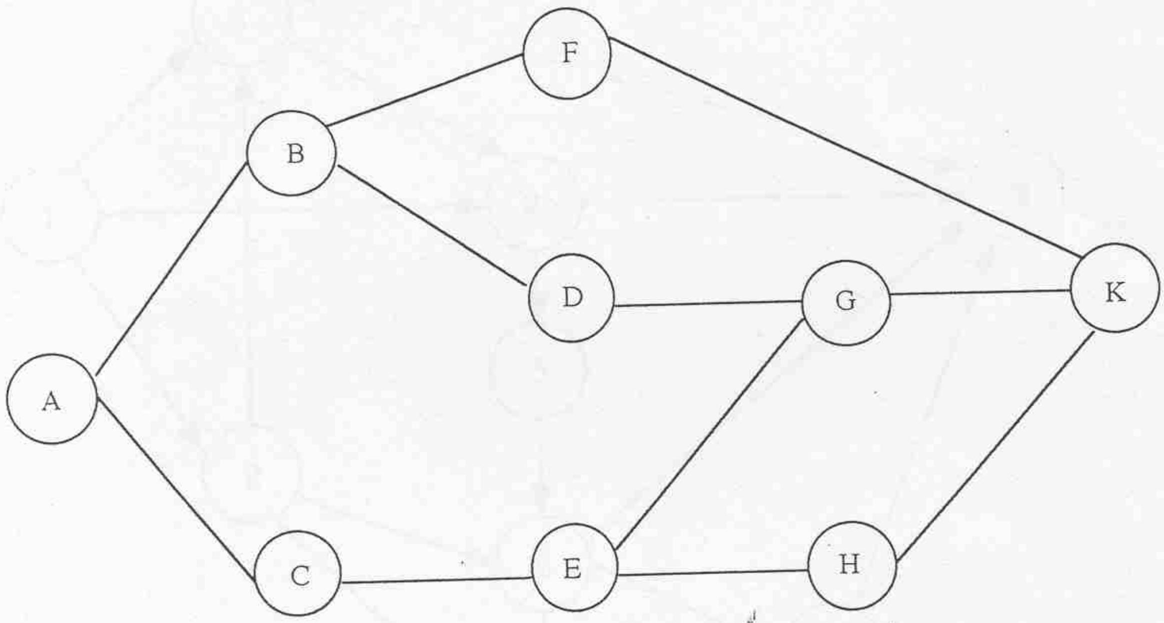
Problem 4: (10%)

Write the PERT formulas as proposed by a) Clarke and b) by Perry and Greig for estimating the mean and standard deviation of activity durations. The Perry and Greig formulas are supposed to be better than Clarke's. Why?

Problem 5: (25%)

Consider the activities of a small project with their durations listed below.

Activity	Duration
A	10
B	6
C	14
D	5
E	6
F	9
G	5
H	6
K	4



a) On the diagram indicate activity start and finish dates along with TF and FF data.