Lebanese American University
Department of Civil Engineering
CIE 485 – Construction Management
TEST 2 – Spring 2010

Date: May 22, 2010, 8:00 a.m.
Duration: 100 minutes

Name	
ID #	

NOTES:
The exam is closed book and notes
Assume any missing information that is necessary
Questions have weights as indicated
Do not unstaple the exam booklet
Exam booklet consists of 13 pages

Problem II (7%)

A contractor files a claim asking the owner for time extension and cost compensation due to a delay in one of its project tasks. Two separate factors contributed to that delay:

1) Severe weather conditions.
2) Another preceding contractor who was working in the same area left without cleaning up the site from all the debris, waste materials, and obsolete construction tools. The current contractor ended up performing the clean up process to be able to start his own work. ⇒ compensable delay.

Classify this delay type and discuss accordingly whether you, being the Owner, will provide the contractor with an extension of time, cost compensation, both or none.

⇒ This is a concurrent delay.

a) If severe weather conditions could have been expected ⇒ non excusable delay.

So nonexcusable + compensable ⇒ non-excusable delay.

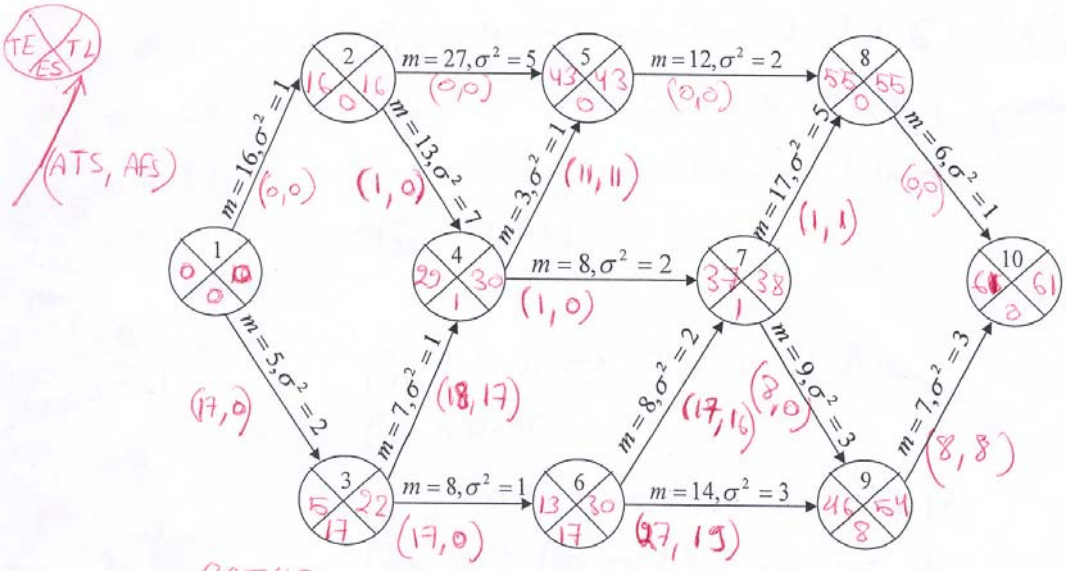
b) If severe weather conditions are not common in that location and thus could not have been expected ⇒ excusable delay

So excusable + compensable ⇒ excusable delay

Problem III (35%)

A small PERT network is shown below. The expected value (m) and the variance (σ2) of the duration of each activity (i,j) have been calculated for you and are shown on the network:

(10) 1. Compute TE_i, TL_i, and ES_i for all events.
(6) 2. Compute ATS_{ij}, and AFS_{ij} for all activities.
(2) 3. Identify the critical path of this project.
(12) 4. Determine the probability that this project will finish in less than 61 days.
(5) 5. The estimated net profit from this project if completed within its expected duration is equal to $750,000. If the contractor exceeds the expected duration, he has to pay a lumpsum liquidated damages equal to $900,000. Find the expected profit for the contractor and advise him whether he should bid on this project or not.



PATHS:

1) 1, 2, 5, 8, 10
2) 1, 2, 4, 5, 8, 10
3) 1, 2, 4, 7, 8, 10
4) 1, 2, 4, 7, 9, 10
5) 1, 3, 4, 5, 8, 10
6) 1, 3, 4, 7, 8, 10
7) 1, 3, 4, 7, 9, 10
8) 1, 3, 6, 7, 8, 10
9) 1, 3, 6, 7, 9, 10

* Critical Path: 1-2, 2-5, 5-8, 8-10

10) 1, 3, 6, 9, 10

Path i	$E[T_i]$	$Var[T_i]$	$SD[T_i]$	$E[T_i]$ -3 SD	$E[T_i]$ +3SD	
1	61	9	3	52	70	←
2	50	12	3.46	39.62	60.38	
3	60	16	4	48	72	←
4	53	16	4	41	65	←
5	33	7	2.64	25.08	40.92	←
6	43	11	3.32	33.04	52.96	←
7	36	11	3.32	26.04	45.96	
8	44	11	3.32	34.04	53.96	←
9	37	11	3.32	27.04	46.96	←
10	34	9	3	25	43	

$P_{12} = 0.385$

$P_{13} = 0.16$

$P_{14} = 0.08$

$P_{15} = 0.378$

$P_{16} = 0.1$

$P_{17} = 0$

$P_{18} = 0.1$

$P_{19} = 0$

$P_{1-10} = 0$

$P_{56} = 0.456$

$P_{68} = 0.726 \Rightarrow$ Eliminate Path 6 (the path with shortest $E[T_i]$)

$P_{32} = 0.65 \Rightarrow$ Eliminate Path 2 (the one with shortest duration)

$P_{24} = 0.578 \Rightarrow$ Eliminate Path 2.

$P_{25} = 0.437$

$P_{36} = 0.6 \Rightarrow$ Eliminate Path 6

$P_{89} = 0.453$

$P_{9-10} = 0.602 \Rightarrow$ Eliminate Path 10

$P_{79} = 0.725 \Rightarrow$ Eliminate Path 7

$P_{47} = 0.6 \Rightarrow$ Eliminate Path 7

$\Rightarrow$ Controlling Paths : 1, 3, 4, 5, 8, 9

$\Rightarrow P(\text{Project Duration} < 61) = P(T_1 < 61) \times P(T_3 < 61) \times P(T_4 < 61) \times P(T_5 < 61) \times P(T_8 < 61) \times P(T_9 < 61)$

$= P\left(\frac{61-61}{3}\right) \times P\left(\frac{61-60}{4}\right) \times P\left(\frac{61-53}{4}\right) \times$ ...

$= 0.5 \times 0.59 \times 1 \times 1 \times 1 \times 1 = 0.295 \approx 0.3$

Another Method:

By only looking at the range for each path, we can determine that Paths 1, 3 and 4 are controlling since there is a chance that they exceed 61 days

$$\Rightarrow P(\text{Project} < 61) = P(T_1 < 61) \times P(T_3 < 61) \times P(T_4 < 61)$$
$$= 0.5 \times 0.59 \times 0.97 = 0.286.$$

5°) If Project completed in less than 61 days

$$\Rightarrow \text{Profit} = 750{,}000\ \$$$

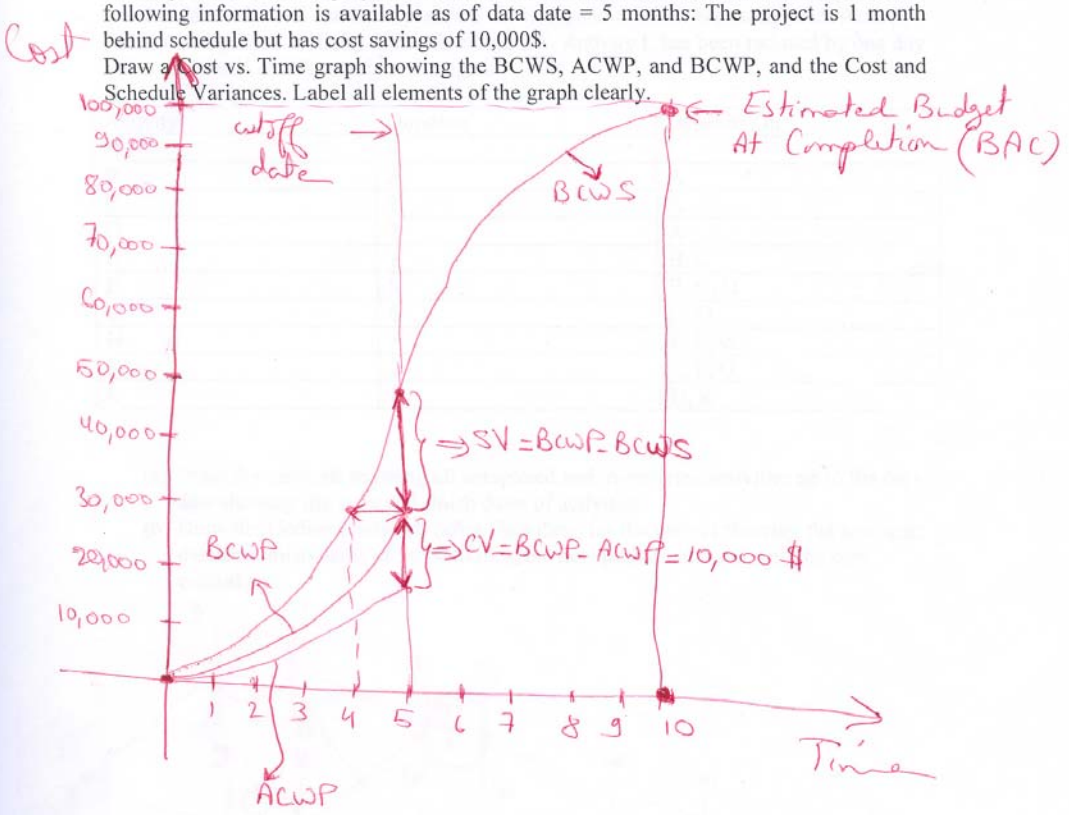
If project exceeds 61 days: Profit $= 750{,}000 - 900{,}000$
$$= -150{,}000\ \$$$

$$\Rightarrow \text{Expected Profit} = 0.3 \times (750{,}000) + 0.7 \times (-150{,}000)$$
$$= 120{,}000\ \$$$

$\Rightarrow$ Advise Contractor to Bid on this project

Problem IV (15%)

The target network for a project has duration of 10 months at a budget of 100,000 $. The following information is available as of data date = 5 months: The project is 1 month behind schedule but has cost savings of 10,000$.
Draw a Cost vs. Time graph showing the BCWS, ACWP, and BCWP, and the Cost and Schedule Variances. Label all elements of the graph clearly.



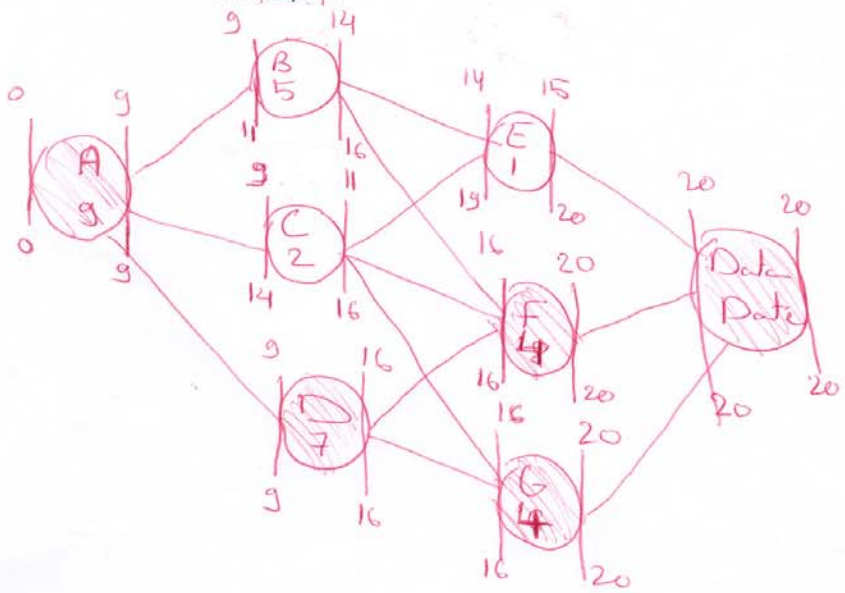
Problem V (15%)

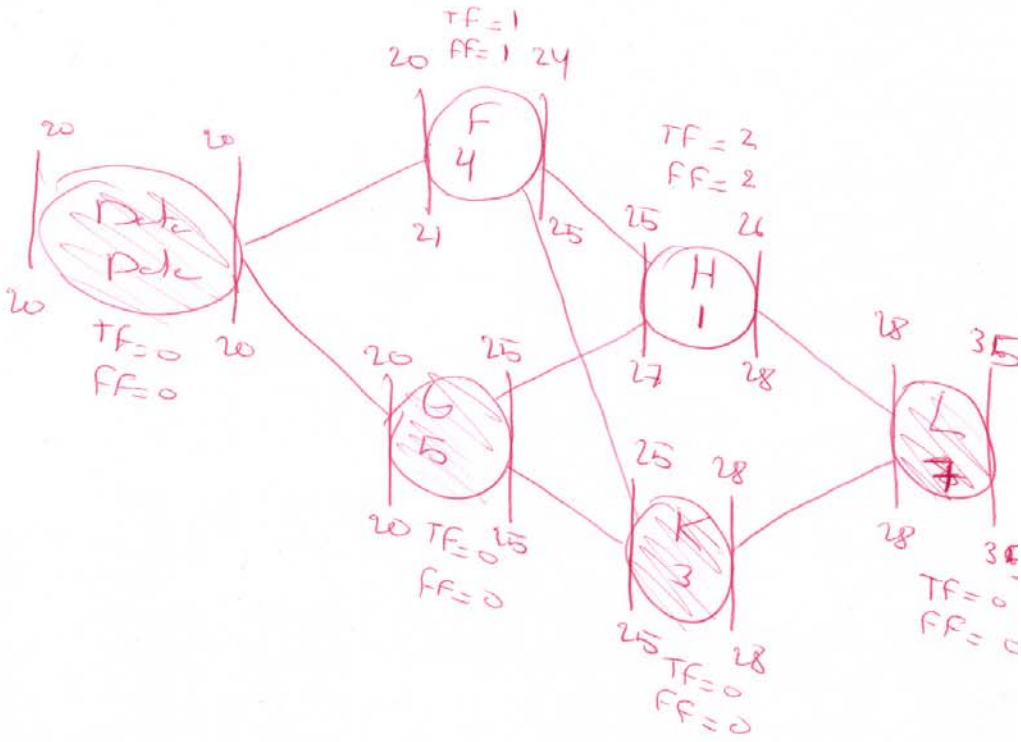
Data for a small project are given below. The initial starting date, or base date, is zero and the data date is 20. All activities except F, G, H, K, and L have been completed. Activity F has four days left. Activity G has five days left. Activity L has been reduced by one day and Activities H and K remain unchanged.

Activity	Duration	Depends On
A	9	-
B	5	A
C	2	A
D	7	A
E	1	B, C
F	8	B, C, D
G	6	C, D
H	1	E, F, G
K	3	E, F, G
L	8	H, K

(a) Draw the network showing all completed and in-progress activities up to the data date showing the start and finish dates of activities.

(b) Draw the Updated network (after Data date) for the project showing the new start date and finish dates of the activities, the new project duration, and the new critical path.




TF = 1
FF = 1
20
24
F
4
20
20
Dele
Dele
20
TF = 0
FF = 0
20
21
25
TF = 2
FF = 2
25
26
H
1
27
28
20
25
G
5
20
TF = 0
FF = 0
25
25
28
K
3
25
TF = 0
FF = 0
28
28
35
L
7
28
TF = 0
FF = 0