Model Answer

Second Mid-term Exam

GE 402 Management of Engineering Projects – 1st Semester 1431- 32H

Sunday, 13 Muharram 1342 H – 19 December 2010
Time allowed: 1.5 hrs

Student name	
Student number	
Section	
Student No. in class	

Total number of Questions: 2
Attempt all questions

Questions	Maximum Marks	Marks obtained
Q # 1	50	
Q # 2	50	
	Total marks	_____ 100

Total marks obtained (in words):_____

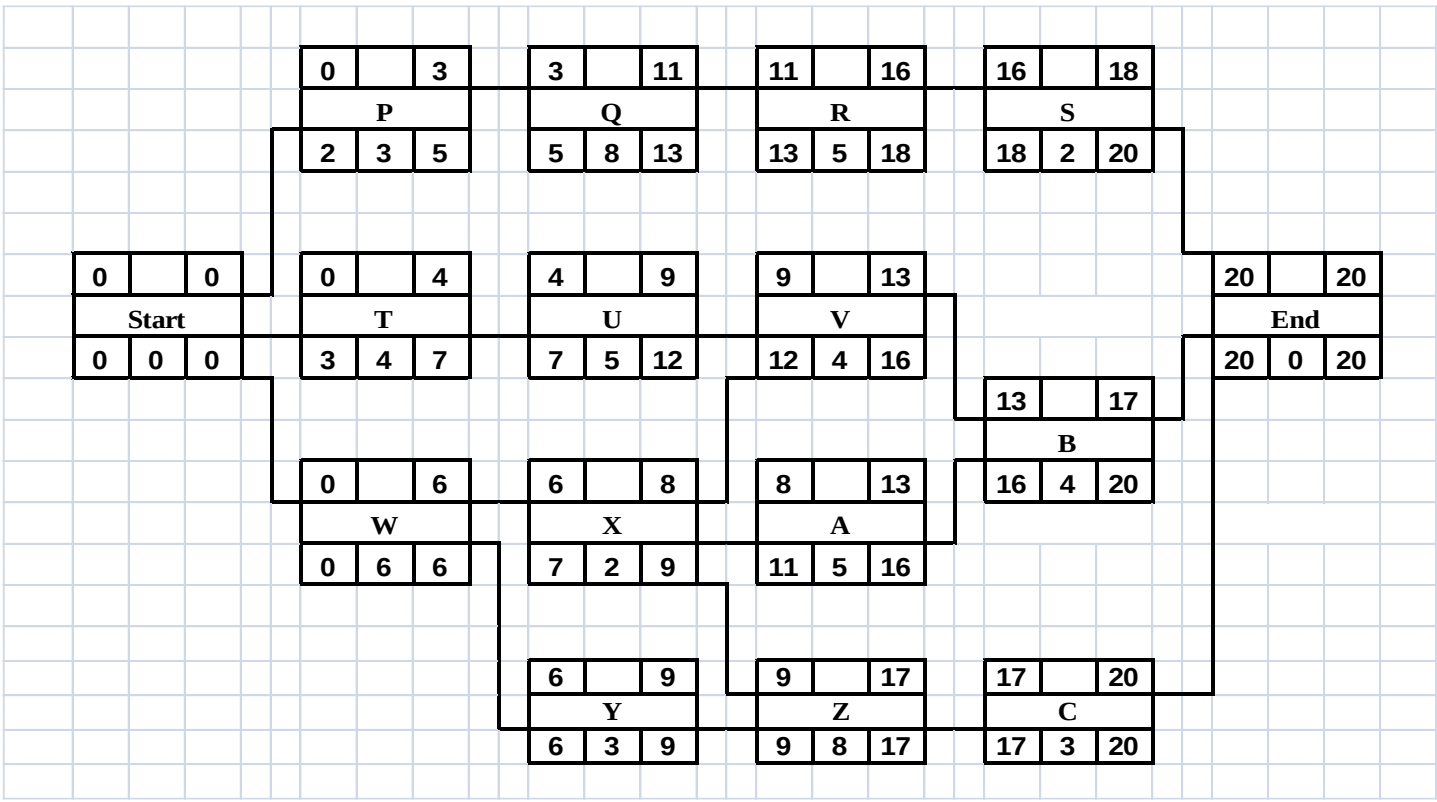
Question 1 (50% of max. credit)

The initial AON diagram for a small engineering project is shown below with its planned activity times in days. At the end of the 10th day, the field progress report gives you the following information:

- Activity “P” was completed on schedule.
- Activity “T” was completed one day later than planned.
- Activity “W” started as planned but two days were lost due to waiting for the required materials.
- Remaining duration of Activity “Q” is 2 days.
- Estimated percentage of completion of activity "U" equals 80%.
- Estimated percentage of completion of activity “X” is 50%.
- Activity “A” cannot start until the morning of day 13.
- Due to owner requirement the volume of work of activity “Z” will be increased by 50%.
- Correct duration of activity “S” is found to be 5 days
- Due to owner requirement the volume of work of activity “B” will be decreased by 25%.
- Activity "B" must depend on activities "R" and "A" instead of activities "V" and "A".
- Duration of activity “C” will be reduced to 2 days instead of 3 days.

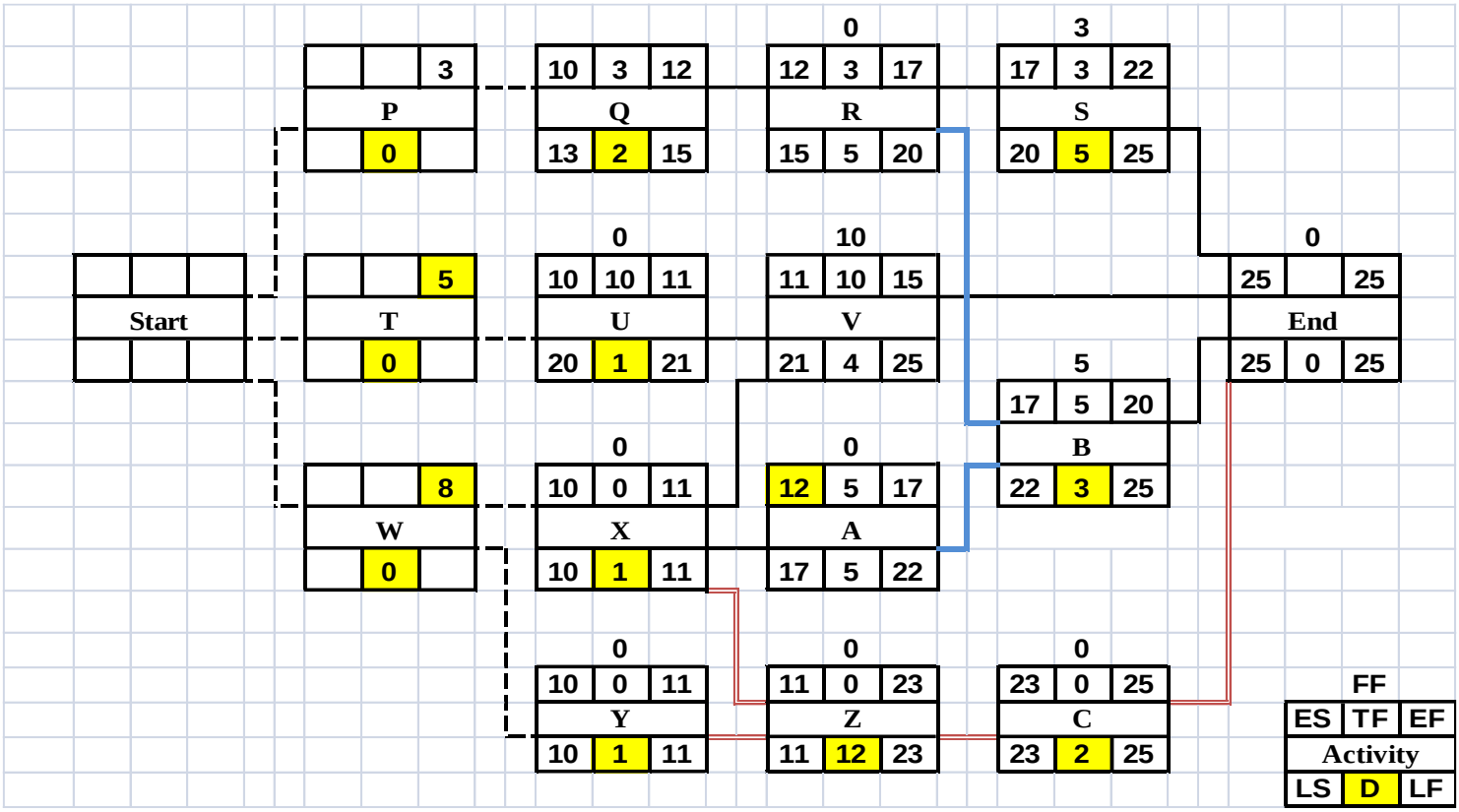
Required:

a. Construct the updated AON diagram, calculate new activity times, total flat and free float, and indicate the critical path(s).
b. If there is a delay in the completion date of the project, what is your recommended action?



Answer Question No. 1

a)



b) The project will be delayed by 5 days. We should determine the party who is responsible for delay. If the contractor is responsible for delay, he should use time-cost trade-off to reduce the project duration time. If the owner is responsible for delay (like activity Z), he should extend the project time and pay overhead costs.

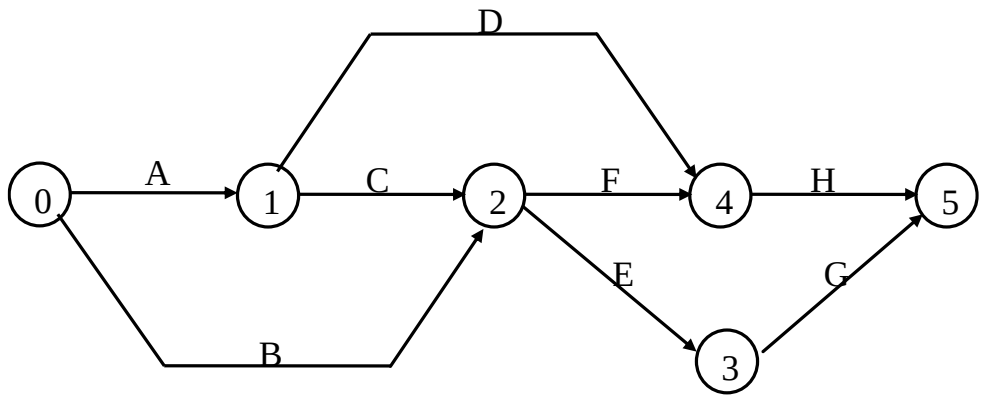
Question 2 (50% of max. credit)

The arrow network for an engineering project and the time-cost trade-off data are given below.

Activity	Normal		Crash	
	Time (days)	Cost (SR)	Time (days)	Cost (SR)
A (0, 1)	8	840	6	1120
B (0, 2)	16	1600	12	2240
C (1, 2)	12	2000	8	2400
D (1, 4)	18	2160	14	2400
E (2, 3)	8	2000	2	4400
F (2, 4)	10	600	8	960
G (3, 5)	6	600	6	600
H (4, 5)	14	2400	12	3000

Compute the minimum total cost of the project if its indirect cost rate is SR 250/day and its desired to be completed as early as possible (reduce project time from normal to crash duration).

Answer Question No. 2



Network paths are:

Network path	Normal time (day)	Crash time (day)
A C E G	8 +12 + 8 + 6 = 34	6 + 8 + 2 + 6= 22
A D H	8 + 18 + 14 = **40**	6 + 14 + 12 = 32
A C F H	8 + 12 + 10 + 14 = **44**	6 + 8 + 8 + 12 = **34**
B E G	16 + 8 + 6 = 30	12 + 2 + 6 = 20
B F H	16 + 10 + 14 = **40**	12+ 8 + 12 = 32

- Crash the project from **44** days (normal time) to **34** days (crash time) using Modified Siemens Algorithm.

Activity	Normal		Crash		Cost Slope (SR/day)	Time Reduction Available (day)
	Time (days)	Cost (SR)	Time (days)	Cost (SR)		
A (0, 1)	8	840	6	1120	140	2
B (0, 2)	16	1600	12	2240	160	4
C (1, 2)	12	2000	8	2400	100	4
D (1, 4)	18	2160	14	2400	60	4
E (2, 3)	8	2000	2	4400	400	6
F (2, 4)	10	600	8	960	180	2
G (3, 5)	6	600	6	600	----	----
H (4, 5)	14	2400	12	3000	300	2

Activity	Path s Requiring Reduction			Cost Slope	Effective Cost Slope	Time Reduction Available
	A-C-F-H	A-D-H	B-F-H			
A (0,1)	2	2		140	70	2 0
B (0,2)			2	160	160	4 2
C (1,2)	4			100	100	4 0
D (1,4)		2		60	60	4 2
F (2,4)	2		2	180	90	2 0
H (4,5)	2	2	2	300	100	2 0

Initial Path Length	44	40	40	Iteration	Action	Iteration Cost	Cumulative Direct Cost
Remaining time reduction required (34 day project duration)	10	6	6	0	-----	---	12200
	8	4	6	1	Cut A by 2 days	280	12480
	6	4	4	2	Cut F by 2 days	360	12840
	4	2	2	3	Cut H by 2 days	600	13440
	0	2	2	4	Cut C by 4 days	400	13840
	0	0	2	5	Cut D by 2 days	120	13960
	0	0	0	6	Cut B by 2 days	320	14280

- **Min. Total cost of the project = 14280 + 34*250 = SR 22780**