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93.5
100

Birzeit University
Faculty of Engineering –Civil Engineering Department
Second Examination for Construction Management (CE532)
Instructor: M. Abed Mousa **Second Semester 2013**

5.5

Problem 1 (30%)

1. Compare between different payments methods in terms of {client flexibility, price certainty, constructors' risk and contingency sum}. You may use numbers from 1-4 where 1 means very low and 4 means very high. (8%)

	Cost Reimbersable	Target cost	BOQ	lump sum
Client flixibility.	4	3	2	1
Price certainty	1	2	3	4
constructor risk	1	2	3	4
contingecy sum	1	2	3	4

VL 1
L 2
A 3
VH 4

2. Mention the advantages and disadvantages of increasing the number of work packages (5%)

Advantages

① Shrink the risk within each work package
② permit high competition on workpackages
③ provid flexibility of design and work

Disadvantage

① fixed cost are increased for the work packages
② the number of interfaces to be controlled or beheld by the client are rapidly increased

3. What are the factors should be considered for choosing a payment method (4%)

① The degree of certainty about the final price of project or contracter tender price
② the flixibilty to cope with design change are likely to be encountered during the contract (whether it can be systematically and equatbly evaluated)
③ The incentive for efficient performance for the contracter matched with the incintive for the client to provide the contracter with information and decision
④ The degree and allocation of risk are likely to be encountered during the contract and what is the efficent way of using cost and time to prevent and allocate risks

-5

4. Mention the advantages and disadvantages of using construction management contract as a role of organization (6%)

advantages

① there is an emphasis on managment
② construction is divided into work pachages so this gives higher compitition
③ there is low risk on the managment contracter
④ using (cost plus) as payment method gives flixibility

-3

Disadvatages

① a complete design should be prepared for each work package befor tendering
② a lot of dissicison must be taken early in the design stage so this takes time
③ high risk on client and construction contracter
④ the final price for the project is not known most of the time
⑤ conflict between commercial and profissional roles to the managment contracter
⑥ the risk of claims are increased

-2

-4

5. Mention and ~~give one~~ example for the types of activities used in planning (5%)

① Production activities : such as excavation
② Procurment activities : such as obtain steel
③ Mangrment disicion activities : such as vacation
④ Hammoc activities : such as dewatering
⑤ Dummy activites : activities in presentation to save logical sequences

-0.5

6. Compare between conceptual and elemental cost estimations (6%)

Conceptual

① prepared during the concept phase
② Accuracy = 80%
③ takes a short time (day or less)
④ it relies on historical data, sketches and brief discription of the project
⑤ the owner need it befor budgets and befor commit on design
⑥ it is needed to decide on the projects scope, location, feasibility
⑦ it is done with little information
⑧ the size of the project is generally known

-0.5

elemental

① prepared during the early (preliminary) design phase
② Accuracy =85%
③ takes over 2 weeks
④ accuracy depends on the company historical data in (ft^2) or RS means
⑤ it is prepared for budgting purposes
⑥ it depends on (ft^2) or (sq^2) (quantites) costs not service units
⑦ it must be adjusted for quality

-1

Problem 2 (35%)

For constructing a pipe line whose length is 4km in a small village, the quantities for excavation and backfilling was estimating to be 200m^3 and 180m^3 respectively. The price of backfilling material is \$40/m^3, and the price for pipe line is \$250/MR including all fittings. According to the contract a performance test whose cost is \$400 will be carried out every 500m. The labor and equipment needed for the project and their outputs are summarized in tables below

Labor	Description	Rate\$ /hr
L_G	General labor	10
L_S	Skilled labor	20

Equipment	Description	Rental \$/hr	Operational \$/hr
E_2	Hydraulic Backhoe excavator	\$50	\$25
E_4	Dumpers	\$30	\$20
E_8	Welding machine	\$22	\$8

Crew	Description	Output/8hrs	Unit	Composition
EX_1	Excavation crew	80	M^3	$6L_G+1E_2+2E_4$
PL_2	Pipe laying crew	150	MR	$4L_G+2L_S+1E_2+2E_8$
BF_1	Backfilling crew	100	M^3	$8L_G+1E_2$

Teams EX and PL will works 13 hours a day and team BF will work for 10 hours. The productivity during overtime is 85% of normal one. The overtime rate is 1.75 normal. Find

1. The direct cost for each activity (Excavation, pipe laying and Backfilling)

1 Excavation :

$D = \frac{\text{Quantity}}{\text{productivity}}$, productivity $= 80 + (80 \times \frac{5}{8} \times 0.85) = 122.5$ m^3/dy

Duration / Time $= \frac{200 \text{ m}^3}{122.5 \text{ m}^3/\text{dy}} = 1.63$ days

Cost: $6L_G \times (10 \times 8 + 10 \times 5 \times 1.75) \times 1.63 = 1638.15$ \$ $(3 \times 6 \times 10 + 6 \times 5 \times 10 \times 1.75) +$

$1E_2 \times 75 \times 13 \times 1.63 = 1589.25$ \$

$2E_4 \times 50 \times 13 \times 1.63 = 2119$ \$

Excavation cost = 5 346.9 \$

2 Pipe laying

Productivity $= 150 + (150 \times \frac{5}{8} \times 0.85) = 229.69$ m/day

Duration $= \frac{4000 \text{ m}}{229.69 \text{ m/dy}} = 17.41$ days

Cost :

material $= 4000 \text{ m} \times 250 \frac{\$}{\text{m}} = 1\,000\,000$ \$

Q2, (1)

Crew cost: $4L_g \times (10\times8 + 10\times5\times1.75) \times 17.41 = 11664.7$ $

$2L_s \times (20\times8 + 20\times5\times1.75) \times 17.41 = 11\,664.7$ $

$1E_2 \times 75 \times 13 \times 17.41 = 16\,974.75$ $

$2E_8 \times 75 \times 13 \times 17.41 = 13\,579.8$

Crew cost $53\,883.95$ $

Pipe lying cost = 1 053 883.95 $

[3] Back filling

Productivity = $100 + (100 \times \frac{2}{8} \times 0.85) = 121.25\ m^3/dy$

Duration = $\frac{Q}{P} = \frac{180\ m^3}{121.25\ m^3/dy} = 1.48$ days

a 3

cost:

material cost = $180\ m^3 \times 40 \frac{\$}{m^3} = 7200$

Crew cost: $8L_g \times (10\times8 + 10\times2\times1.75) \times 1.48 = 1361.6$ $

$1E_2 \times 75 \times 10 \times 1.48 = 1110$ $

2471.6 $

Backfilling cost = 9671.6 $

Total D.C = 1068901.95 $

Total duration = 20.52

-1

2. Assuming the costs of the staff who will supervise the project is $2500/week and the week is 5 working days. Find the project overhead for the project (6%)

cost of supervision = $\frac{2500\ \$}{5\ days} \times 20.52\ days = 10\,260\ \$$

cost of test = $\frac{400\ \$}{500\ m} \times 4000\ m = 3200\ \$$

-1

$POH_p = 13\,460\ \$$

-0

3. If the construction contractor has another 3 projects whose direct costs is estimates to be $200,000 and the general overhead for all projects is estimated to be $10,000 find the general overhead for pipe laying activity assuming bid balance (8%)

$GOH_{p=} GOH_{comp} \times \frac{DC_p}{TDC} = 10\,000 \times \frac{1\,068\,901.95}{1068901.95 + 200\,000}$

$GOH_{p=} 8423.83$

$GOH_{Pipe} = GOH_p \times \frac{DC_{pip}}{DC_{Proj}} = 8423.83 \times \frac{1053883.95}{1068901.95}$

$GOH_{pipe} = 8305.48\ \$$

-0

4. Based on your answer in 2 and 3 and assuming the markup is 20% of the direct cost of the project find the unit price for pipe laying activity ($/MR) (6%)

markup = $20\% \times DC = \frac{20}{100} \times 1068901.95 = 213\,780.39\ \$$

Total price = DC + POH + markup

= 1068901.95 + 13460 + 213780.39

$POH_{pipe} = POH_p \times \frac{DC_{pip}}{DC_{pr}} = 13460 \times \frac{1053883.95}{1068901.95} = 13\,270.89\ \$$

markup = $20\% \times 1053883.95 = 210\,776.79$

piping total price = DC + POH + GOH + markup

= 1053883.95 + 13270.89 + 8305.48 + 210776.79

price = 1 286 237.11 $

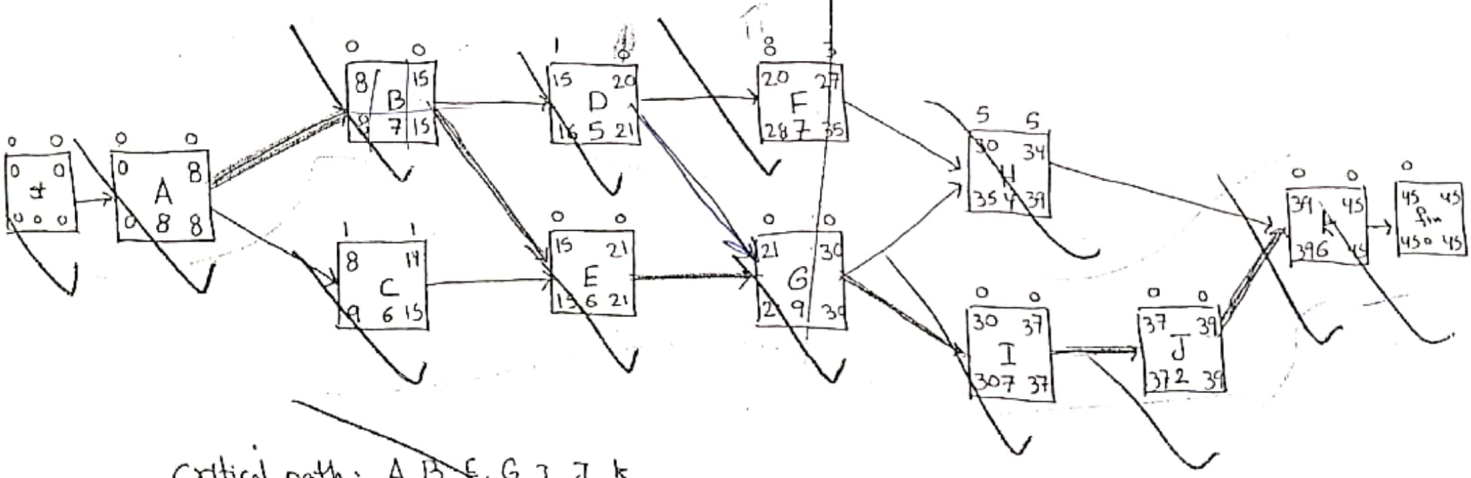
unit price = price / 4000 m = 321.56 $/m

-4

Problem 3 (35%)

1. For the project summarized in table below draw the AON network and find ES,EF, LS,LF, TF and FF for all activities and show the critical path. (20%)

Activity	Duration (days)	Depends upon
A	8	-
B	7	A
C	6	A
D	5	B
E	6	A,B,C
F	7	B,D
G	9	D,E
H	4	D,F,G
I	7	G,E
J	2	I
K	6	J,H

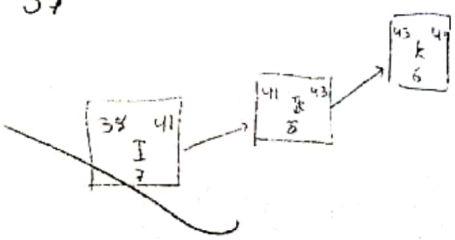


Critical path: A, B, E, G, I, J, K

2. If activity I is delayed for 4 days what will be the new project completion date (5%)

when activity I delayed 4 days it will start at day 34

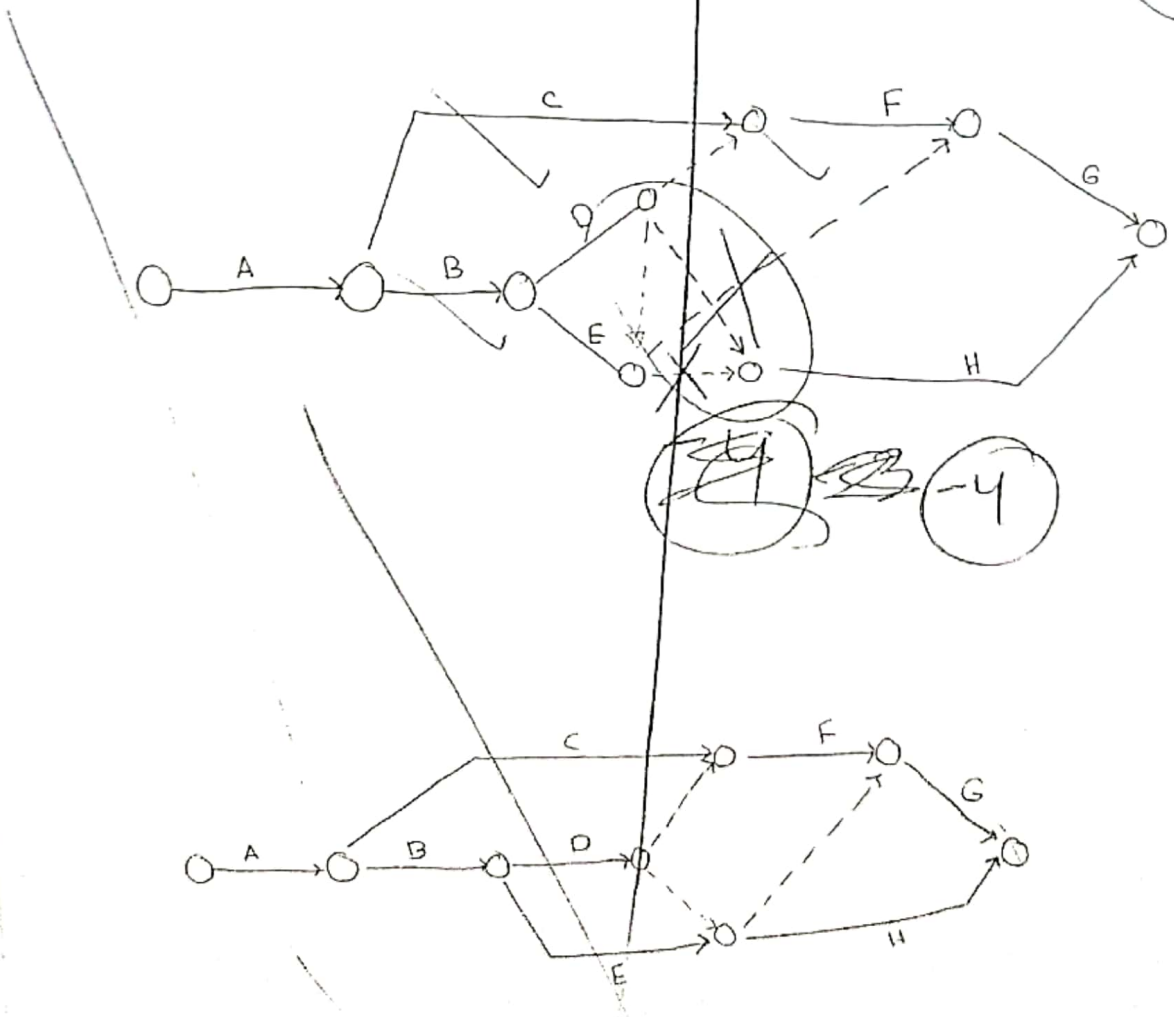
and because it has no float (critical) it will cause a delay in the project and the project will finish at day 49



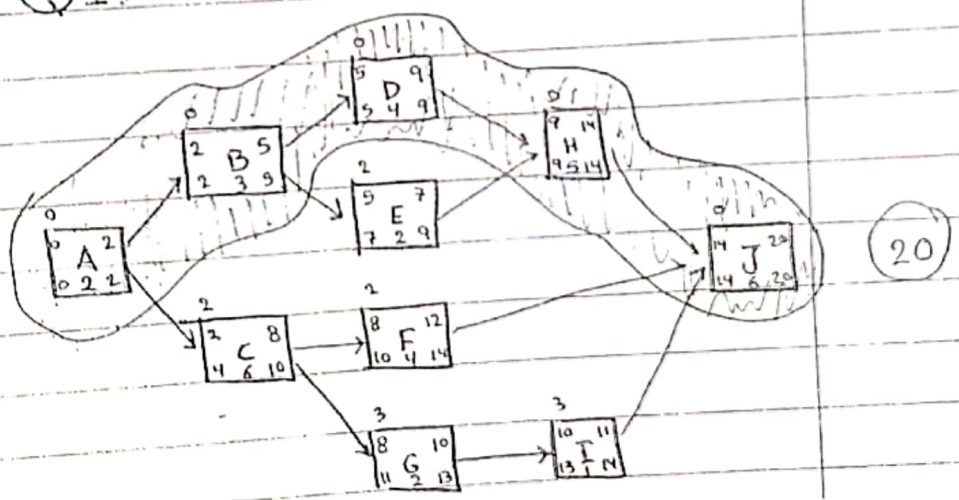
-4 3. Construct AOA network according to the activity descriptions below. (10%)

- Activity B depends on Activity A
- Activity G follows activities E,F,D
- Activity E depends on Activities B and A
- Activity F can start when activities D and B are completed
- Activity C is followed by Activity F and follows activity A
- Activity D depends upon activities A and B
- Activity H depends on activities D and E

A	-
B	A
C	A
D	A,B
E	A,B
F	D,B,C
G	E,F,D
H	D,E



Q1:



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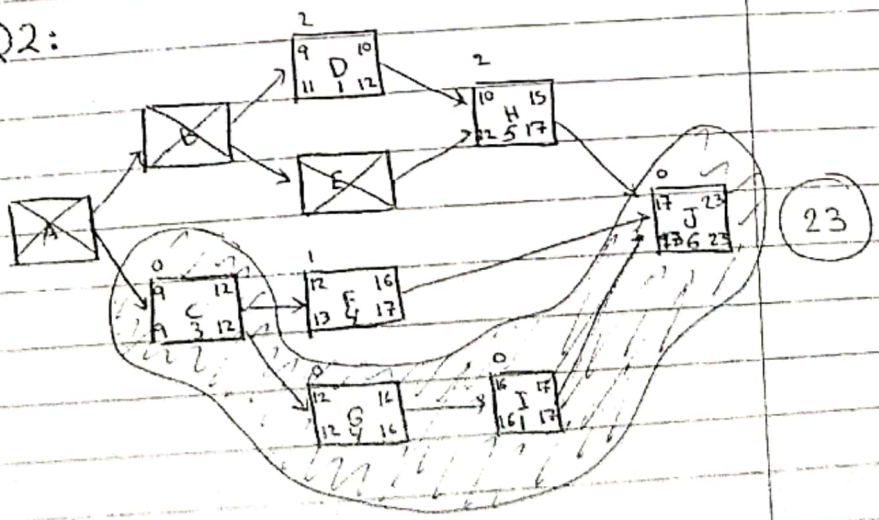
Q2:



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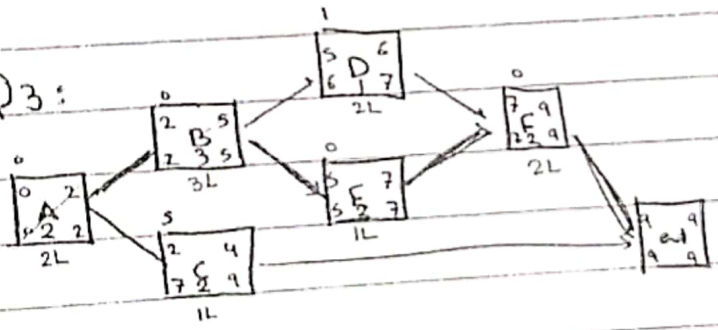
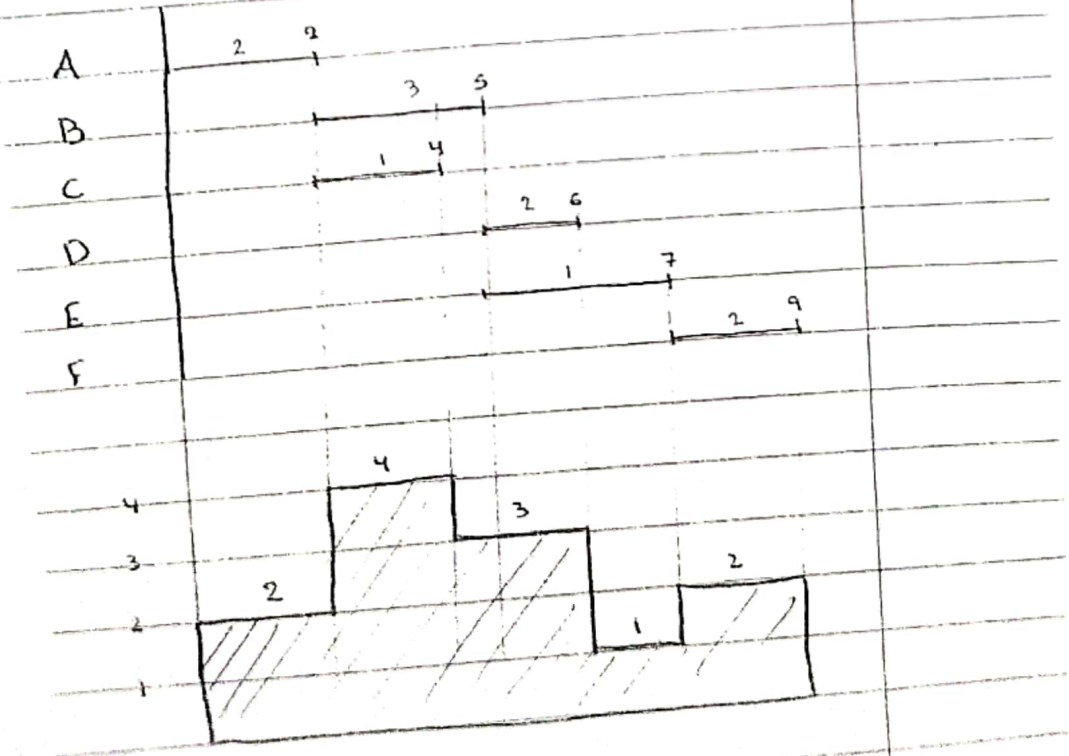
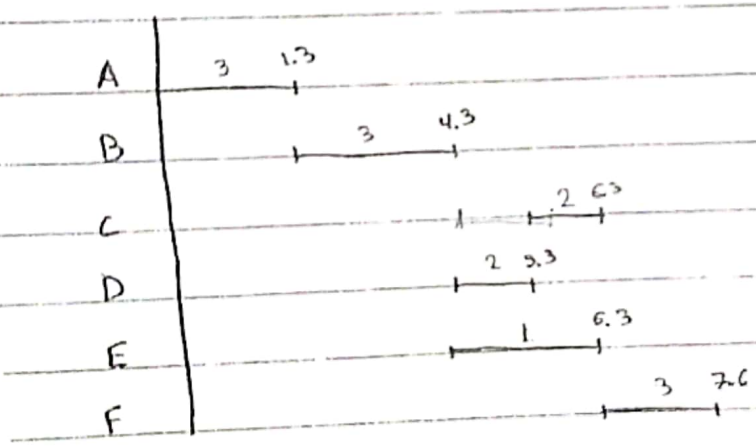
Q3:







A: 2L : 2D → 1L : 4D → 3L : 1.3D

B: 3L : 3D

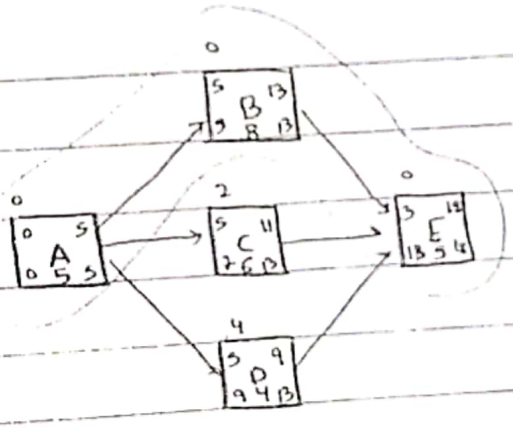
C: 1L : 2D → 2L : 1D

D: 2L : 1D

E: 1L : 2D

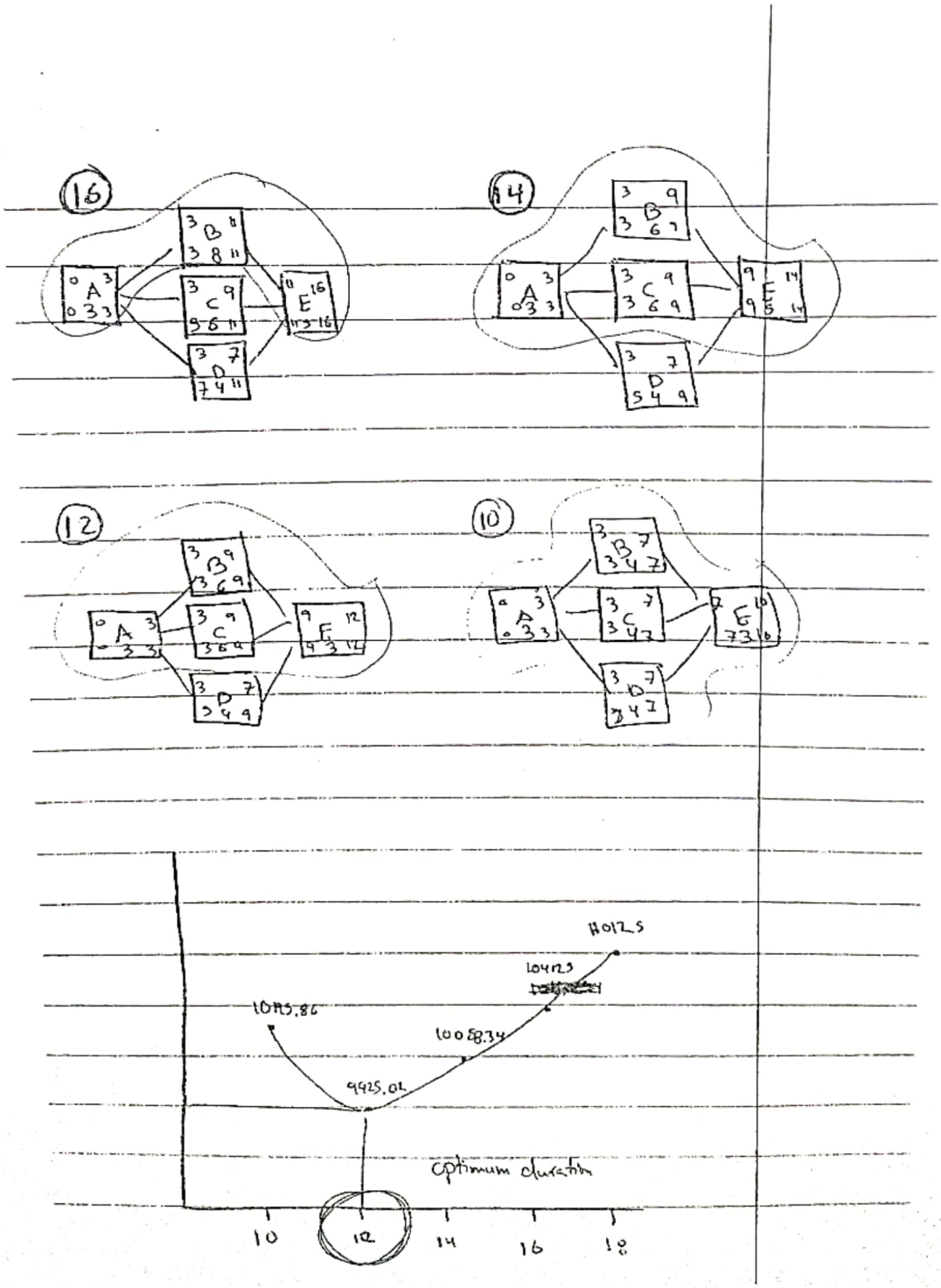
F: 2L : 2D → 1L : 4D → 3L : 1.3D

Q3:



activity	N.D	C.P	N.C	C.C	6bpc	
A	5	3	400	800	200	← ① ✓
B	8	2	3125	2250	322.92	← ③
C	6	4	500	1125	312.5	← ② ✓
D	4	—	500	~~500~~	—	
E	5	3	300	1166.67	433.34	← ④ ✓

D	18	16	14	12	10
I.C	9000	8000	7000	6000	5000
D.C	2012.5	2412.5	3058.34	3925.02	5195.86
T.C	11012.5	10412.5	10058.34	9925.02	10195.86
		2A	2B	2E	2B, 2C



Q4:

		expenses	surplus	price
1st	10%	30000	4500	34500
2nd	25%	75000	11250	86250
3rd	20%	60000	9000	69000
4th	20%	60000	9000	69000
5th	15%	45000	6750	51750
6th	10%	30000	4500	34500
Total		300000	45000	345000

Payments

1st = 34500 - 3450 - (20% x 75000)

= 16050

2nd = 86250 - 8625 - (30% x 75000)

= 55125

3rd = 69000 - 6900 - (30% x 75000)

= 39600

4th = 69000 - 6900 - (20% 175000)

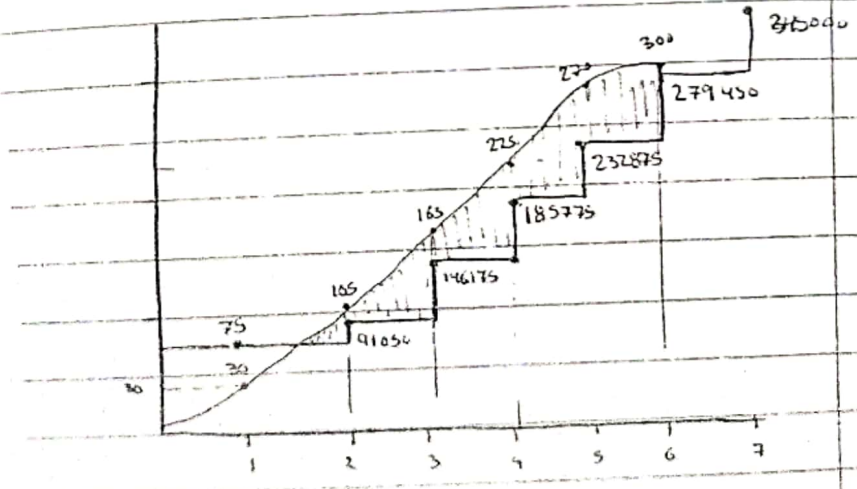
= 47100

5th = 51750 - 5175 =

= 46575

6th = 34500 + 5175 + 6900 + 6900 + 8625 + 3450

= 65550



BIRZEIT UNIVERSITY

Second

Faculty of Engineering
Civil Engineering Department
Final Examination for Construction Management -CE 330
Instructor: Eng. Mustafa Abedmousa

May 2009

final

Time allowed: 150 minutes

The allocation of marks within each question is stated.

Students may need this table.

z	Probability of Meeting Due Date	z	Probability of Meeting Due Date	z	Probability of Meeting Due Date
3.0	0.999	0.8	.788	-1.4	.081
2.8	0.997	0.6	.726	-1.6	.055
2.5	0.995	0.4	.655	-1.8	.036
2.4	0.992	0.2	.579	-2	.023
2.2	0.986	0.0	.500	-2.2	.014
2.0	0.977	-0.2	.421	-2.4	.008
1.8	.964	-.4	.345	-2.6	.005
1.6	.945	-.6	.274	-2.8	.003
1.4	.919	-.8	.212	-3.0	.001
1.2	.885	-1	.159		
1.0	.841	-1.2	.115		

Important

Calculators may be used in this examination but must not used to store text. Calculators with the ability to store text should have their memories deleted prior to the start of the examination.

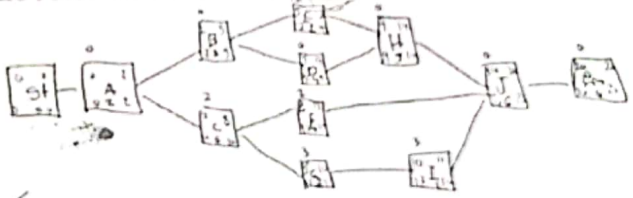
The table below shows the activities for a construction project. Determine the project duration, the earliest and latest start times and finish times for each activity, the total float of each activity and the critical path (12%)

Activity	Duration (days)	Preceded by activity no.
A	2	-
B	3	A
C	6	A
D	4	B
E	2	B
F	4	C
G	2	C
H	5	D,E
I	1	G
J	6	F,I,H

ABDHJ

2. For the previous section, knowing that the review at the end of day 9 was as following

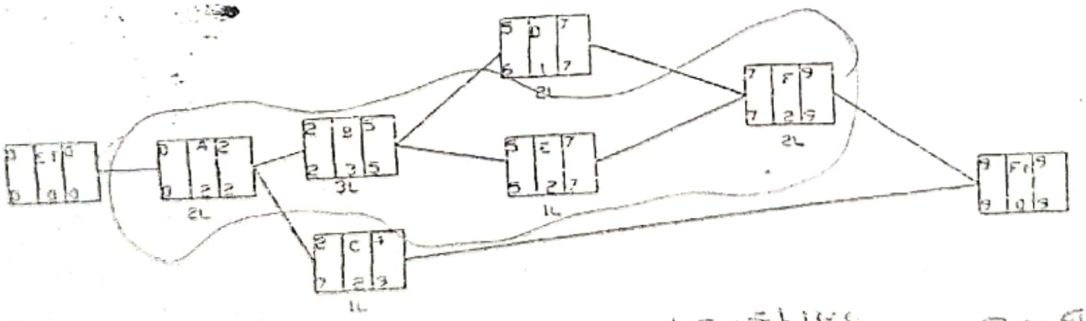
a. A complete
b. B complete
c. C → 3 days more
d. D → 1 day more
e. F → 4 days more
f. E complete
g. G 4 days more
h. J 6 days more
i. H 5 days more
j. I 1 day more



Update the network, and show the new project completion date, the total float of each activity and the critical path. (8%)

3. The network in the figure is for a project in which the key resource is labours. The network has been evaluated on the assumption that an unlimited number of labours is available and the duration of the project is then 9 days as shown.

- Draw the histogram showing the demand for labours if each activity is started at the earliest start time. (4%)
- Assuming that, no activity can be split, schedule the start of each activity if only 3 labours are available and determine the effect on the project duration. (6%)



RESOURCE LEVELING P = 9

project is composed of 7 activities whose time estimates are listed in the following table. Activities identified by their beginning (i) and ending (j) node numbers.

Activity		Estimated Duration (weeks)		
i	j	Optimistic	Most likely	Pessimistic
1	2	1	1	7
1	3	1	4	7
1	4	2	2	8
2	5	1	1	1
3	5	2	5	14
4	6	2	5	8
5	6	3	6	15

1. Draw The project network and identify all paths through it
2. Find the expected duration and variance for each activity
3. Calculate the early and late occurrence time for each node, what is the expected project length?
4. Calculate the total slack (float) for each activity
5. What is the variance and standard deviation of the project length?
6. What is probability that the project will be completed
   - At least 3 weeks earlier than expected?
   - No more than 3 weeks later than expected?
7. If the project due date is 18 weeks, what is the probability of not meeting the due date?
8. What due date has about a 90 percent chance of being met?

Question #3 (30%)

A small project consists of the jobs in the following table. Within each job is listed its normal time and crash time in days. The normal and crash cost of each activity is also given.

Activity	Preceded by	Normal duration (days)	Normal cost ($/day)	Crash duration (days)	Crash cost ($/day)
A	-	5	400	3	800
B	A	8	312.5	2	2250
C	A	6	500	4	1125
D	A	4	500	4	500
E	B,C,D	5	300	3	1166.67

Assume that a linear cost relationship exists between job duration and job cost. In addition, a job may be scheduled not only at normal and crash durations but also, at any integer duration in between. With overhead costs at $500/day, plot the cost-time relationship.

Cost slope:

A 200

B 22.92

C 12.5

D 0

E 866.67

A contractor is preparing a bid for a project. He has made his cost estimation together with the schedule of work. The expected expenses which include both direct and indirect costs are $300,000. The project duration is 6 months, and the contractor is planning to add 15% to his estimated expenses in order to cover overhead and profit expenses (markup). The table below shows the progress of works based on expenses.

1st month		10%
2nd month		25%
3rd month		20%
4th month		20%
5th month		15%
6th month		10%

Assume that the contractor wins the project and sign the contract agreement with the owner at the bid value stated above. The contractor plans to submit his progress payment to the client at the end of each month. Upon approval, the owner will deduct 10% for retainage (retention) and pays the contractor one month later. The accumulated retainage will be paid with the last payment.

The owner decides to pay 25% of the contract value to the contractor at the start time of the project as mobilization payment. The amount of advance payment will be deducted from each progress payment as follows.

- From the first payment 20%
- From the second payment 30%
- From the third payment 30%

78/100

Birzeit university

Faculty of Engineering- Civil Engineering Department

Second Examination for Construction Management

Instructor: Mustafa Abedmousa Time allowed: 90minutes

-16

Question 1: (30%)

It is required to build a retaining wall whose steel, formwork timber and concrete steel quantities are 50 tonne, 2000m^2 and 350m^3 respectively. Assuming that the normal working hours is 8. The rate for labour overtime per hour is 1.5x normal rate. The steel and woodwork crews productions during an overtime hour is 90% and 80% respectively of their production during normal working hours. Moreover, the number of crews which will be assigned for woodwork, Steel fixing and pouring concrete are 3, 1 and 2 respectively. Using tables below to answer the following questions regarding constructing this wall whose surface area is 1000m^2, if the crew of steel fixing and timber wood have to work 14 and 10 hours per day respectively.

Labor and materials:

Code.	Description	Rate/hr	Code	Description	Unit	Cost/unit
L1	General laborer	$2.10	M10	Ready mix concrete	M^3	$85
L2	Shuttering carpenter	$3.5	M12	Bar reinforcement	Tone	$700
L3	Concrete worker	$5.3	M13	Structural timber	M^2	$39
L4	Steel fixer	$3.5				

Equipment

Code	Description	Rental $/hr	Operational $/hr
E2	Reinforcement bending machine	1.00	1.40
E14	Concrete vibrator	0.80	1.8
E24	Pump and tool	3	5

Crew:

Code	Description	Unit	Daily Output	Composition
C10	Woodwork crew	M^2	32.1	3L1+ 2L2
C15	Steel fixing crew	Tone	2.7	4L1+3L4+2E2
C20	Concrete crew	M^3	69	4L1+2L3+2E14+1E24

1. The total and unit direct cost required to construct the wall (15%)

2. Using Bar chart to calculate the min duration required to complete this wall assuming that formwork should be finished at least one day after finishing steel fixing. Pouring concrete needs at least one day after formwork. Removal of formwork can be commenced after 4 days of pouring concrete with production rate of for one crew. 200m^2 per 8 hours. Note assume the worker will work continuously. (10%)

the project overhead is 20% of the direct cost of this project, calculate the steel unit price assuming balanced bid (5%)

Problem 2(45%)

A work project consists of 12 activities labeled A to L. If job A comes first and precedes B,C and D. Both B and C must be done before E starts and C and D must precede F, but G and H can start as soon as D is completed. Job I succeeds D,E, F and G. Jobs J and K can start when G, H and I are all completed. Job L comes after J and K. (15%)

Eliminate redundancy then list the IPA for each job (6%)

Draw an AOA diagram representation of the project. (9%)

2. For the following set of activities using AON Presentation, find the critical path, ES, EF, LS, LF, total float and free float (20%)

Activity	IPA	Duration (week)
A	-	1
B	A	4
C	A	2
D	B	3
E	C	2
F	C	4
G	D and E	6
H	G and F	1

For the project in part 2, update the network and indicate the critical activities given that today is week 12 and (7%)

a. A, B and C are completed

b. Activities D, E and F are 70%, 50% and 75% are respectively completed.

What will be the final duration if the activity C will be start 5 ~~days~~ weeks after its early start duration (3%)

Problem 3: (25%)

a. In a joinery shop, the same group of joiners are responsible for assembling window frames which are then primed by the painter who also primes the door frames. Assembling and priming a door frame takes 0.5 man-houra and 0.25 man-hours respectively. In case of a window frame, the respective times are 0.75 man-hours and 0.15 man-hours. Profit from the combined assembley and priming of door and window frames is in the proportion 3:5. The number of door and window frames to be produced in a given period so as to maximize profit is required. Formulate the