AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENGINEERING DEPARTMENT

3rd year Civil Eng. Dept. – Fall 2005

4 January, 2006 **Construction Management** Time : 2.0 Hrs

Answer the following questions
Assume any missing data using reasonable numbers

Question (1)

A construction project consists of 37 units, the activities of each unit, their durations, dependences, and number of crews required, are shown in the following table.

Activities	Duration weeks	Predecessor	Total cost per activity $	Number of crews required
A	4	-	8,000	2
B	10	A	20,000	4
C	12	A	19,200	6
D	8	B&C	4,000	4
E	9	C	9,000	4
F	6	A&C	12,000	4
G	4	D&E	7,200	8
H	5	F	10,000	3
I	4	G&H	8,000	4

It is required to:-

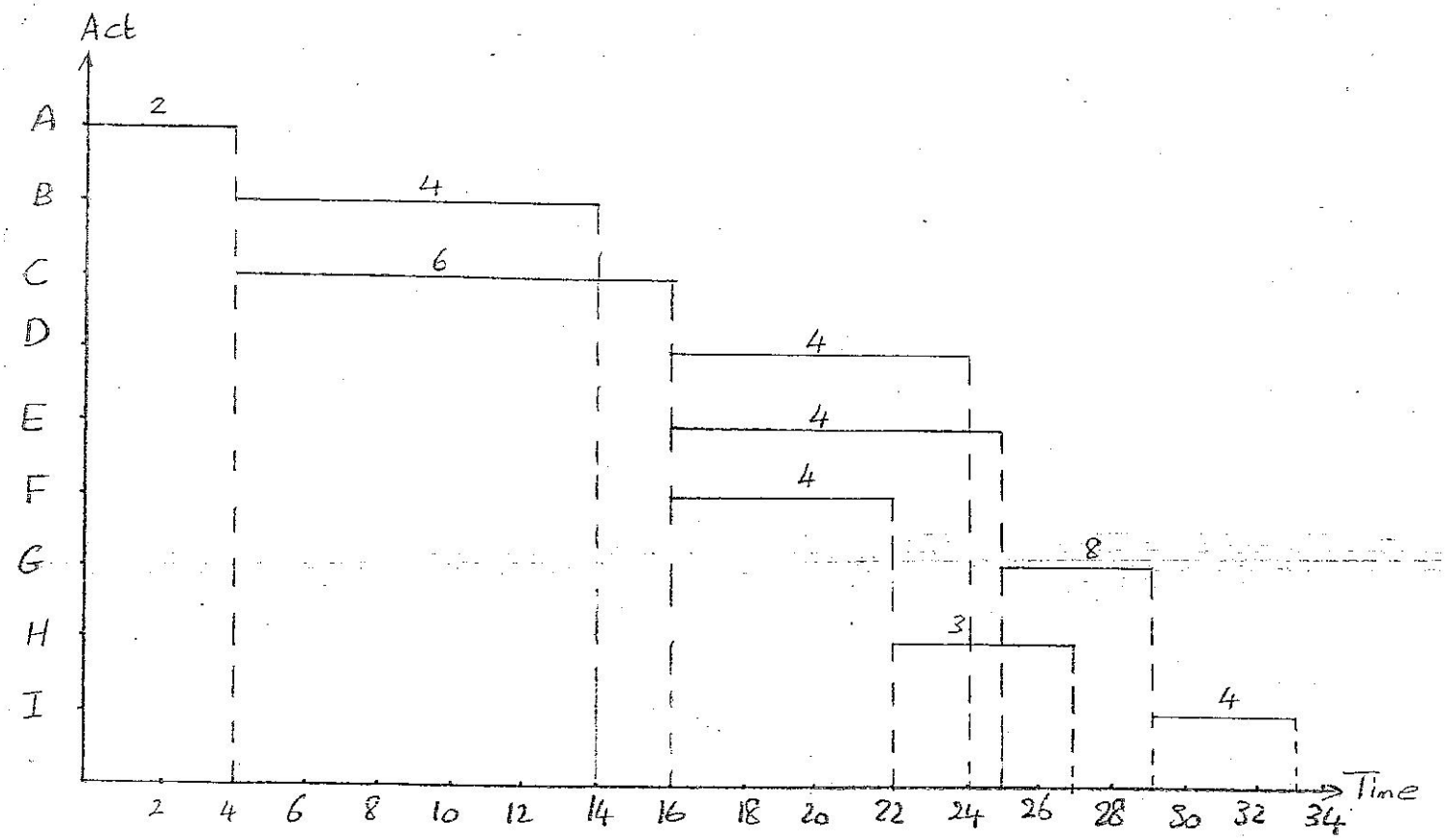
Task (1) - Draw the Bar-Chart for this unit.
Task (2) - Draw the early time histogram for the required crews.
Task (3) - Draw the arrow diagram for one unit.
Task (4) - Draw the precedence diagram for one unit.
Task (5) – Crash the duration of this unit by 3 weeks with the minimum cost
Task (6) – Draw the objective chart for this project (25 units)
Task (7) - Draw the progress chart at week (16).
Task (8)-What is the minimum number of crews that can be used for activities D and E with no effect on the total project duration

Question (2)

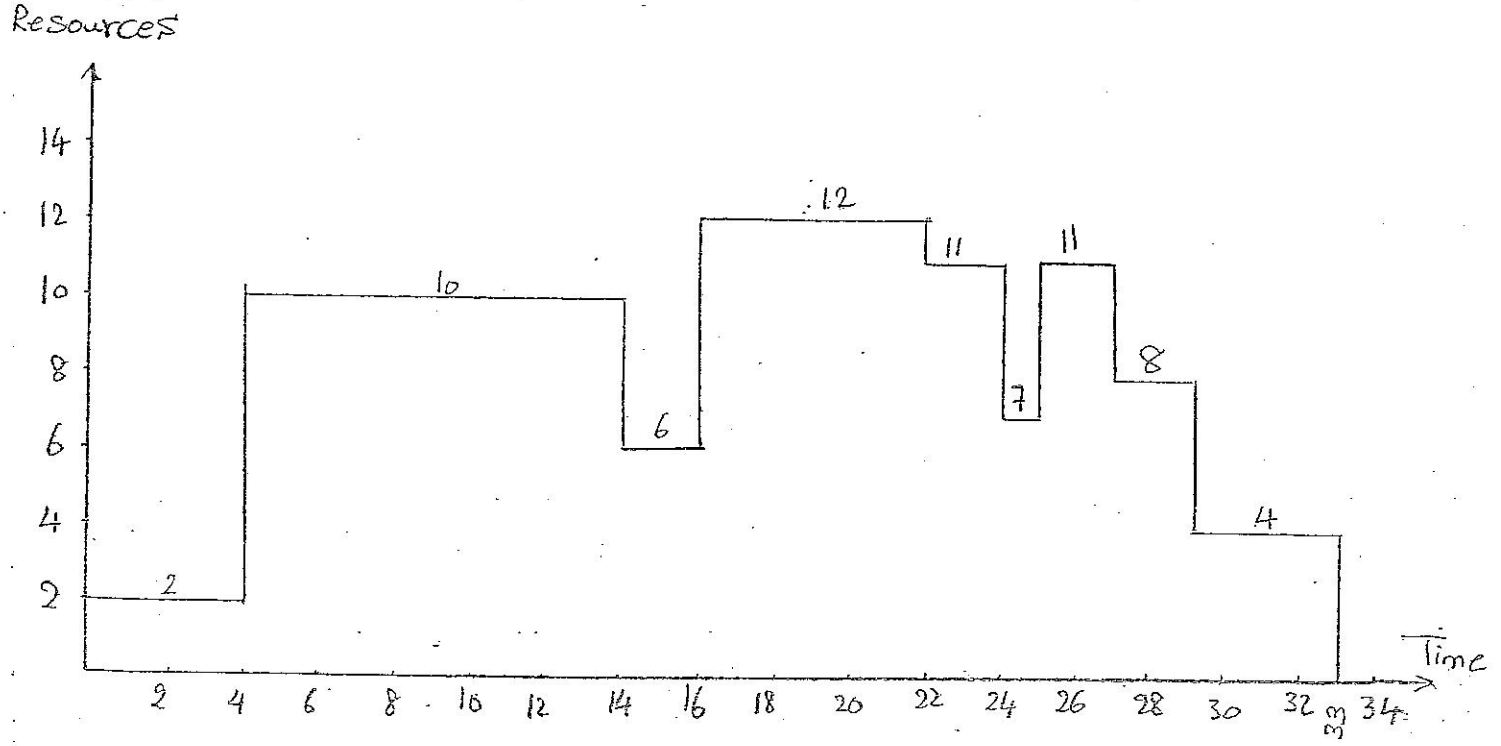
a. Briefly explain three types of contracts and the risk associated with each type
b. Draw a typical construction project curve
c. Complete the following table and calculate:
   1. The cost increase/decrease to date
   2. The expected total *Final* project cost

item no.	Description	Unit	Budgeted Quantity	Quantity to date	% Completed	Budgeted cost	Budgeted cost to date	Actual cost to date	Cos diff
1	excavation	m^3	700	490		14,000		10,800	
2	piles	lm	550	575	100	220,000	220,000	230,000	
3	forms	m^2	340	170		40,800		36,100	
4	concrete	m^3	450	150		270,000		92,000	
5	steel	ton	300	210		960,000		575,000	
6	finishes	ls	ls		20	300,000		80,000	
TOTALS									

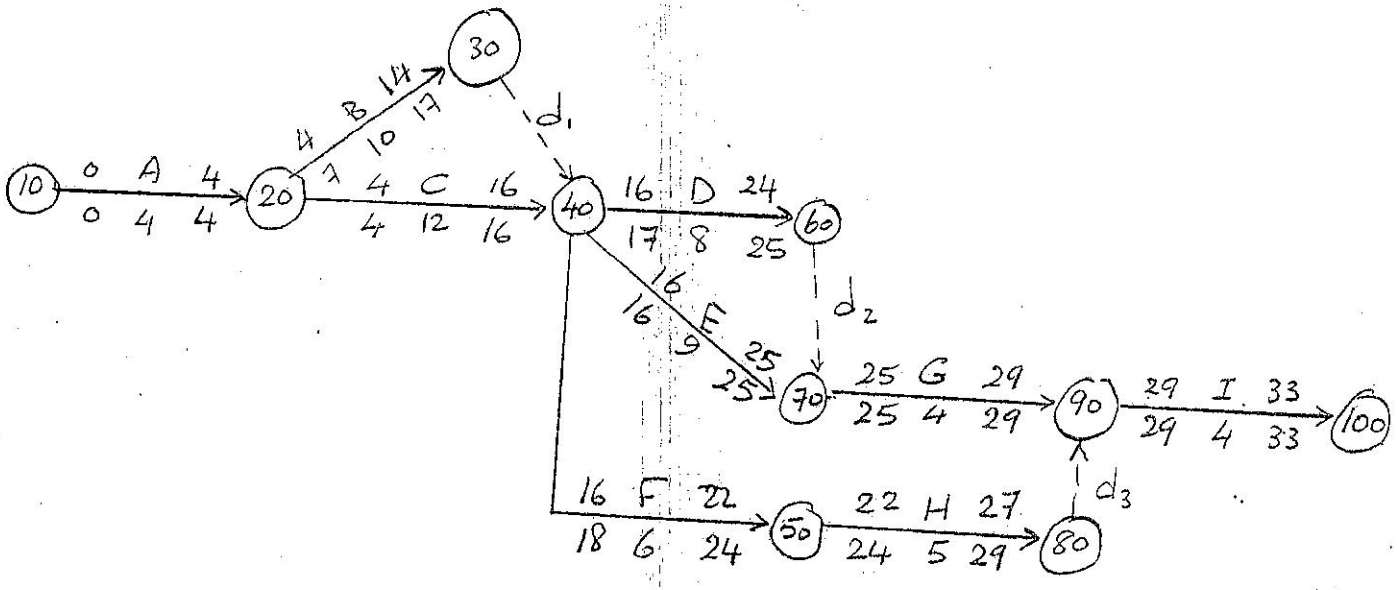
Task (1)


Act
A
B
C
D
E
F
G
H
I
2
4
6
4
4
4
8
3
4
Time
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34

Task (2)

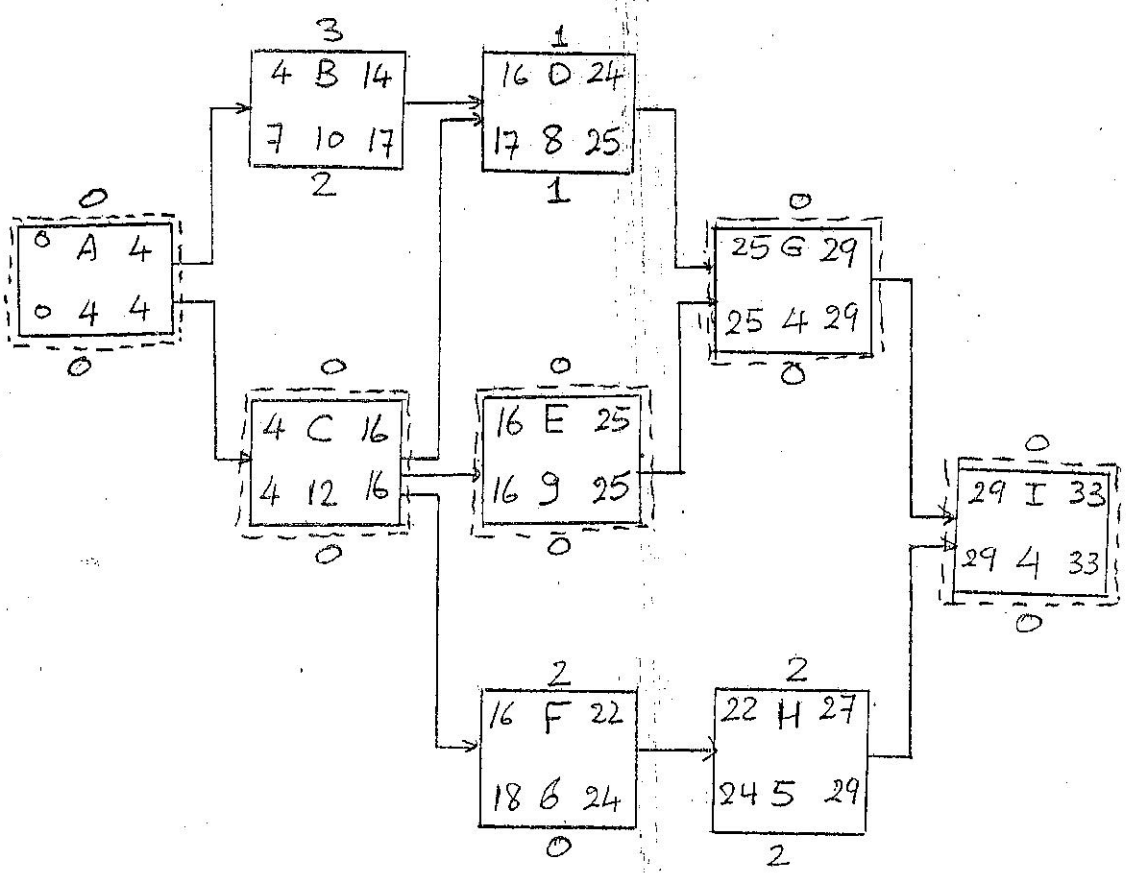

Resources
14
12
10
8
6
4
2
2
10
6
12
11
7
11
8
4
Time
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34

Task (3)



Arrow Diagram

Task (4)

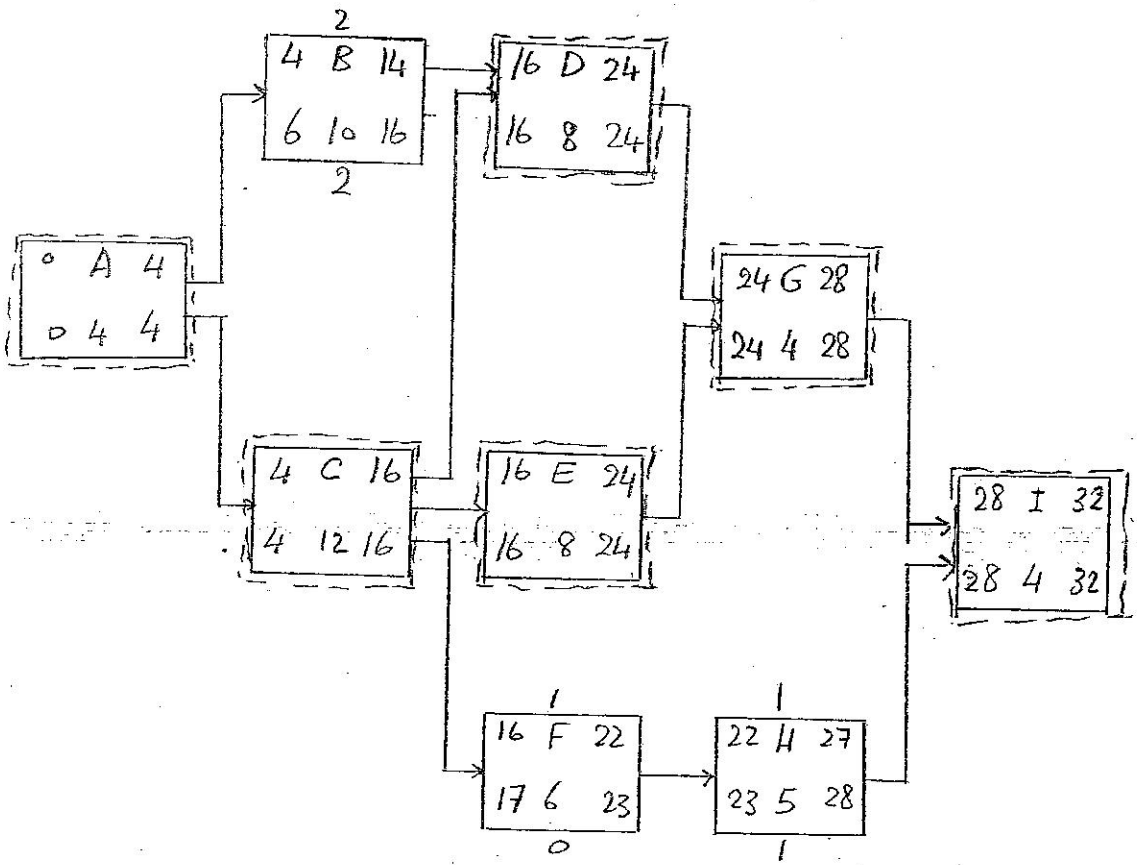


Critical path A - C - E - G - I

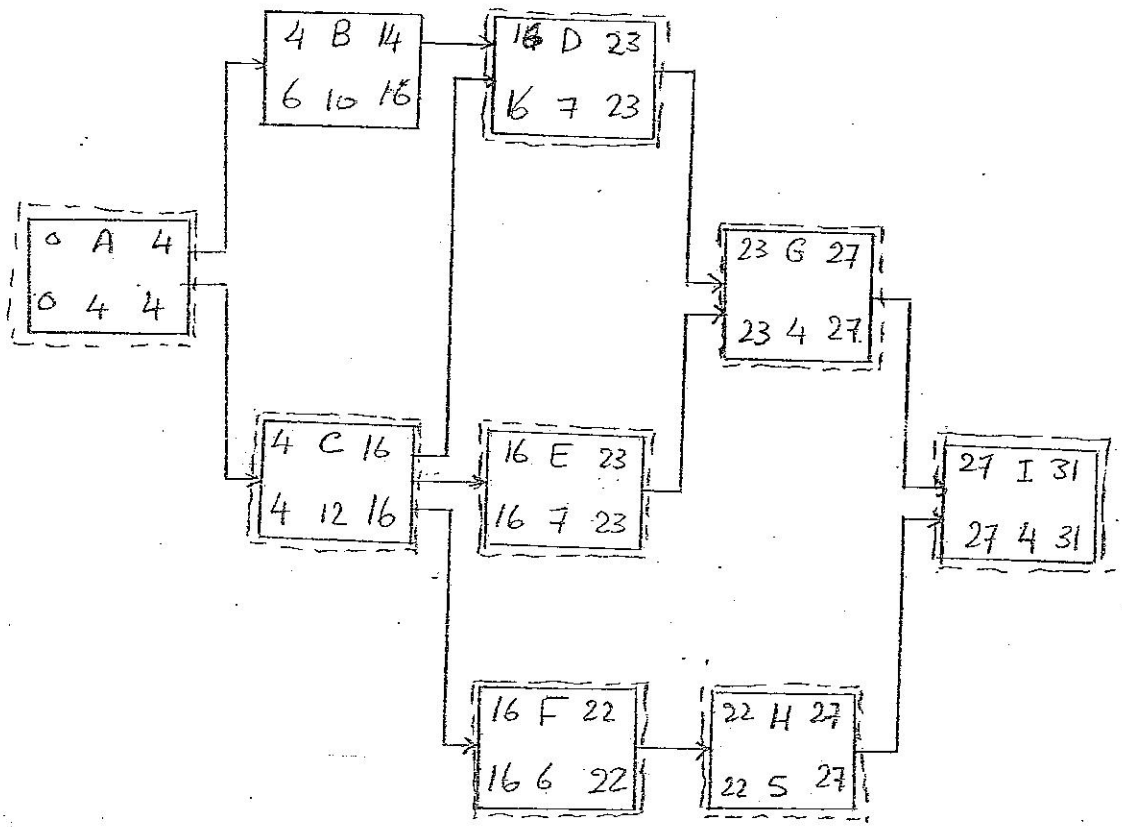
Act	Cost per unit week
A	2000
B	2000
C	1600
D	500
E	1000
F	2000
G	1800
H	2000
I	2000

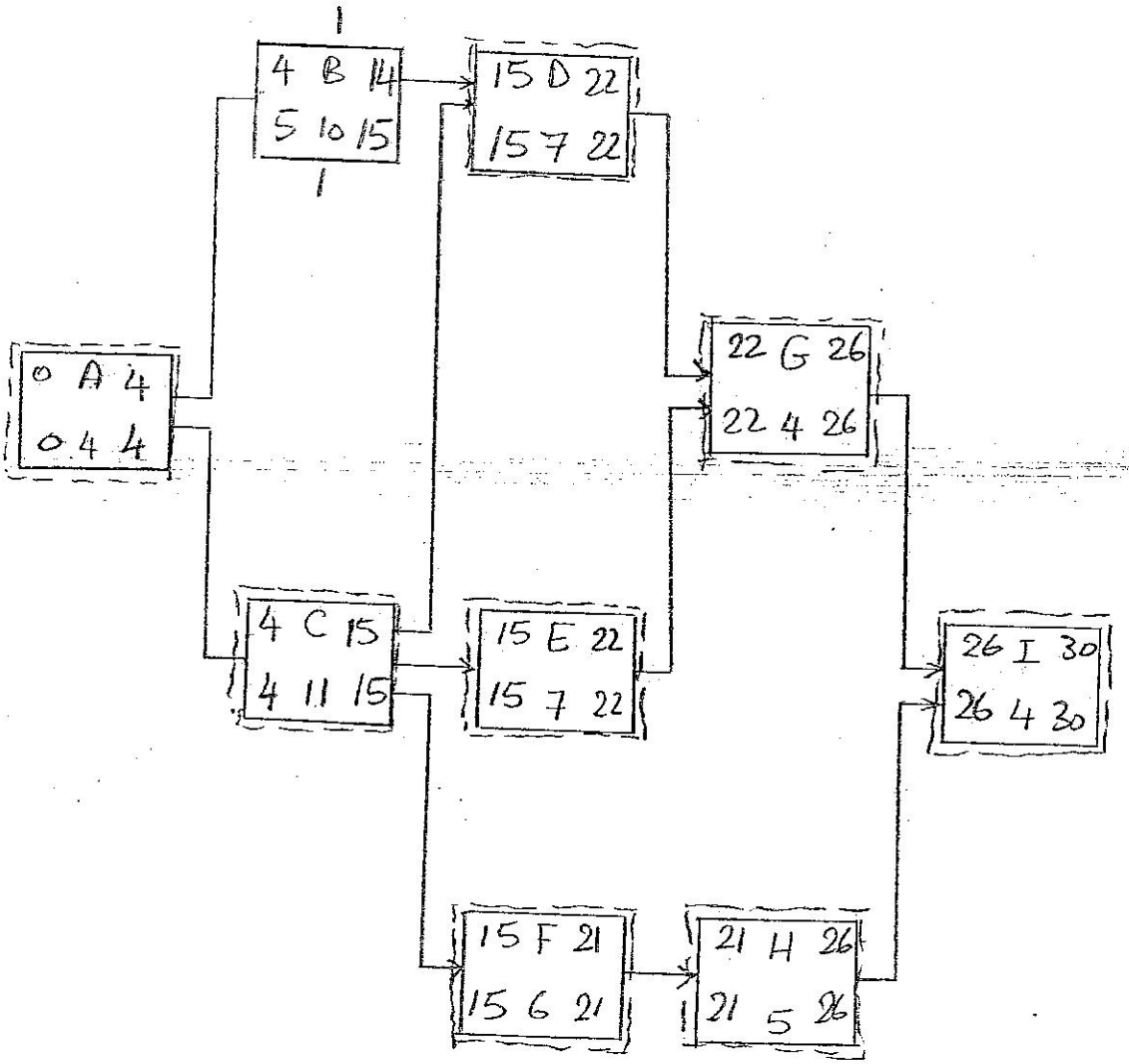
Task (J)

* Crash 1st week From Activity E = $1000



* Crash 2nd week From Activities D+E = 500 + 1000 = $1500




0 A 4
0 4 4
4 B 14
5 10 15
15 D 22
15 7 22
22 G 26
22 4 26
4 C 15
4 11 15
15 E 22
15 7 22
26 I 30
26 4 30
15 F 21
15 6 21
21 H 26
21 5 26

Task (6) Rate = $\frac{\text{No. of Crews}}{\text{Duration}}$

Act (A) $R_A = 0.5$

$t_o = 4$

$t_f = 4 + \frac{(25-1)}{0.5}$

$= 52$

Act (B) $R_B = 0.4$

$R_B < R_A$

$t_o = 14$

$t_f = 14 + \frac{24}{0.4} = 74$

Act (C) $R_C = 0.5 = R_A$

$t_o = 16$

$t_f = 16 + \frac{24}{0.5} = 64$

Act (D) $R_D = 0.5$

$R_D > R_B$

$t_{f_D} = t_{f_B} + D_D$

$= 74 + 8 = 82$ ✓

$t_{o_D} = 82 - \frac{24}{0.5} = 34$ ✓

$R_D = R_C$

$t_{o_D} = 24$

$t_f = 24 + \frac{24}{0.5} = 72$

Act (E) $R_E = \frac{4}{9} = 0.445$

$R_E < R_C$ $t_o = 25$

$t_f = 25 + \frac{24}{0.445}$

$= 79$

Act (F) $R_F = \frac{4}{6} = \frac{2}{3}$

$R_F > R_C \Rightarrow t_{f_F} = 64 + 6 = 70$

$t_o = 70 - \frac{24}{2/3} = 34$

Act (G) $R_G = \frac{8}{4} = 2$

$R_G > R_D \Rightarrow t_{f_G} = 82 + 4 = 86$ ✓

$t_o = 86 - \frac{24}{2} = 74$ ✓

$R_G > R_E \Rightarrow t_{f_G} = 79 + 4 = 83$

$t_{o_G} = 83 - \frac{24}{2} = 71$

Act (H) $R_H = 0.6$

$R_H < R_F$

$t_{o_H} = 34 + 5 = 39$

$t_f = 39 + \frac{24}{0.6} = 79$

Act (I) $R_I = 1.00$

$R_I < R_G$

$t_o = 74 + 4 = 78, t_f = 78 + \frac{24}{1.0} = 102$ ✓

$R_I > R_H$

$t_f = 79 + 4 = 83$

$t_o = 83 - \frac{24}{1.0} = 59$

For activity (D) :

$t_{o_{min}} = t_{o_C} + D_D = 16 + 8 = 24$

$t_{f_{max}} = t_{f_G} - D_G = 86 - 4 = 82$

$\therefore R_{new} = \frac{25-1}{82-24} = \frac{24}{58} = 0.414$

min no. of crews $= 0.414 * 8 = 3.312 \simeq 4$ Crews

For activity (E) :

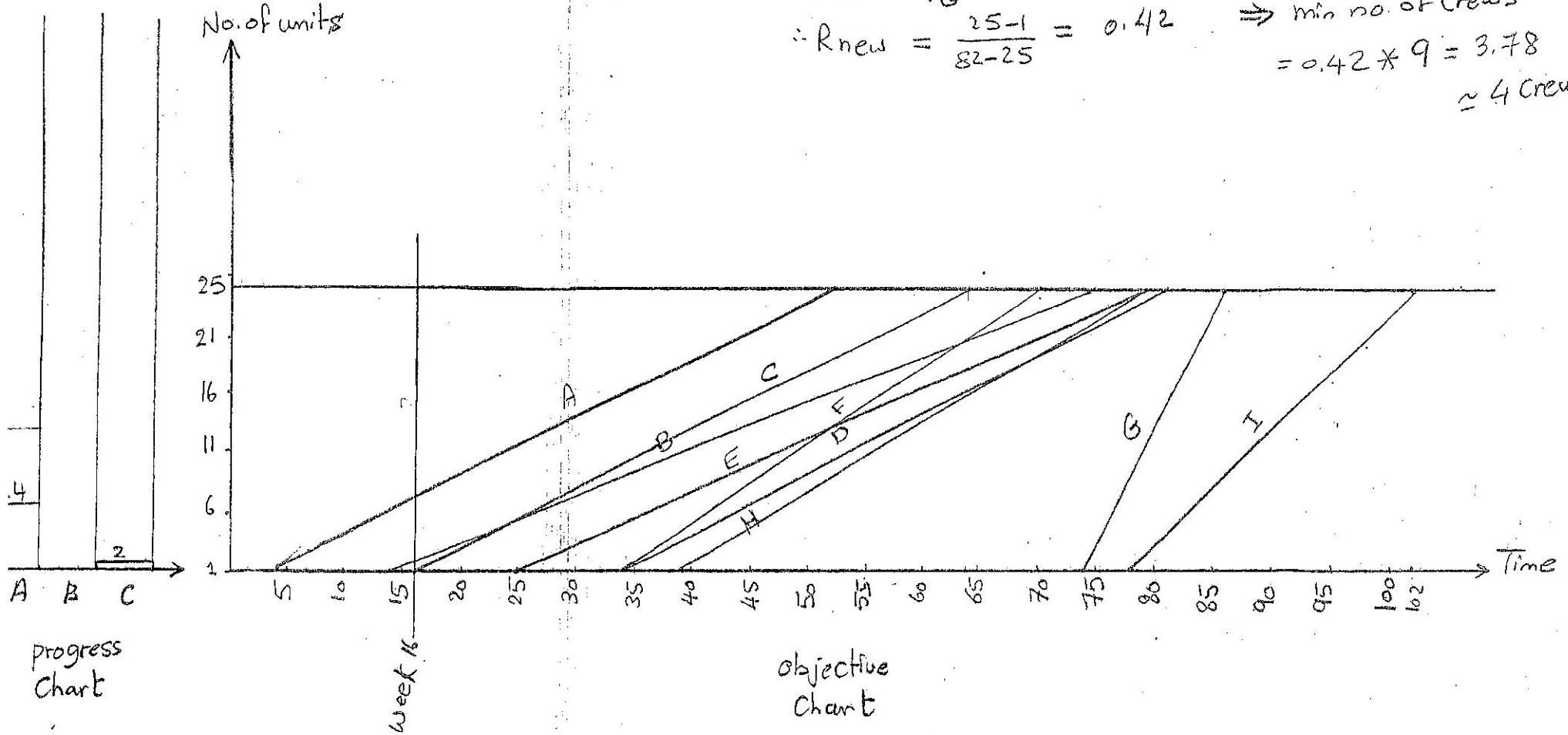
$t_{o_{min}} = t_{o_C} + D_E = 16 + 9 = 25$

$t_{f_{max}} = t_{f_G} - D_G = 86 - 4 = 82$

$\therefore R_{new} = \frac{25-1}{82-25} = 0.42 \Rightarrow$ min no. of crews

$= 0.42 * 9 = 3.78$

$\simeq 4$ Crews



AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

STRUCTURAL ENGINEERING DEPARTMENT

3rd year civil eng. Dept. – Fall 2003

Jan., 2010 | Construction management | *Time : 2.0 Hrs*

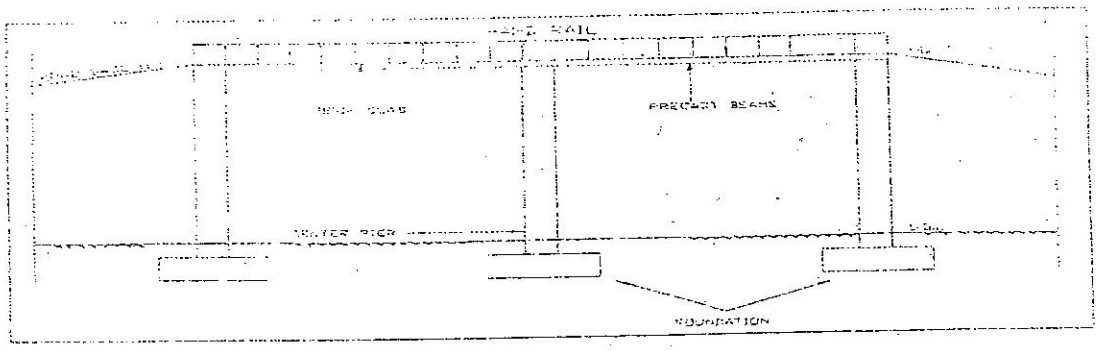
Construction project Management

Answer the following questions

Assume any missing data with a reasonable numbers

Question (1)

The following figure shows a double span bridge. Activities of the bridge, and their durations are given in the table.



Act. Num.	Activity	Duration (weeks)	Act. Num.	Activity	Duration (weeks)
10	Set up site	2	100	Construct center pier	6
14	Procure reinforcement	5	110	Place deck beams left	1
16	Procure deck beams	10	120	Place deck beams right	1
20	Excavate foundation left	2	140	Fill embankment left	10
30	Excavate foundation right	2	150	Fill embankment right	12
40	Excavate foundation center	3	155	Construction R.C. deck slab	8
50	Construct foundation left	2	160	Road base left	3
60	Construct foundation right	2	170	Road base right	3
70	Construct foundation center	2	180	Surface road	2
80	Construct abutment left	4	190	Erect bridge railing	2
90	Construct abutment right	4	200	Clear site	1

ired

a- Construct the precedence network, arrange the network according to the following statements, and calculate the ES,LS,EF,LF,TF, and FF, for each activity.

- Activities 10, 14, and 16 have no predecessors.
- Activity 10 must be completed before activities 20,30, and 40 can be start
- Activity 14 must be completed before activities 50,60, and 70 can be start
- Activity 50 can not start until activity 20 is finished
- Activity 60 can not start until activity 30 is finished
- Activity 70 can not start until activity 40 is finished
- Activity 80 can not start until activity 50 is finished
- Activity 90 can not start until activity 60 is finished
- Activity 100 can not start until activity 70 is finished
- Activities 80, 100, 16 must be completed before activity 110 can be start
- Activities 90,100, 16 must be completed before activity 120 can be start
- Activity 140 can not start until activity 80 is finished
- Activity 150 can not start until activity 90 is finished
- Activity 155 can not start until activities 110, 120 are finished
- Activity 140 must be finished before activity 160 can be start
- Activity 150 must be completed before activity 170 can be start
- Activity 155 must be completed before activities 180, 190 can be start
- Activities 160, 170 must be finished before activity 180 can be start
- Activity 200 can not start until activities 180, 190 are finished

b- If the construction of the left foundation has been delayed by one week, determine total float available for the construction of the left abutment.

Question (2)

1. The construction of a housing project involves the activities given in the following table. The contract is for the construction of twelve houses in 60 days. The man-hours for each activity and the crew size/house are also given. Prepare the objective chart for the contract. Assume a minimum time of one day and six 8-hour days per week. What is the overall project duration and when will the first team of roof leave the site.

Activity	Description	Predecessors	Man-hours	Team Size / Section
10	Substructure	-	100	4
20	Superstructure	10	200	8
30	Roof	20	60	4
40	Carpenter	30	90	6
50	Plumber	30	45	3
60	Electrician	30	40	3
70	Plaster	40, 50, 60	120	8
80	Final fix	70	350	24

estion (3)

- It is required to reduce the project duration from 25 to 19 working days with a minimum increase in cost (the cost slope for all activities under a crash program is shown below). Determine the percentage of cost increase in relation to the normal project direct cost.

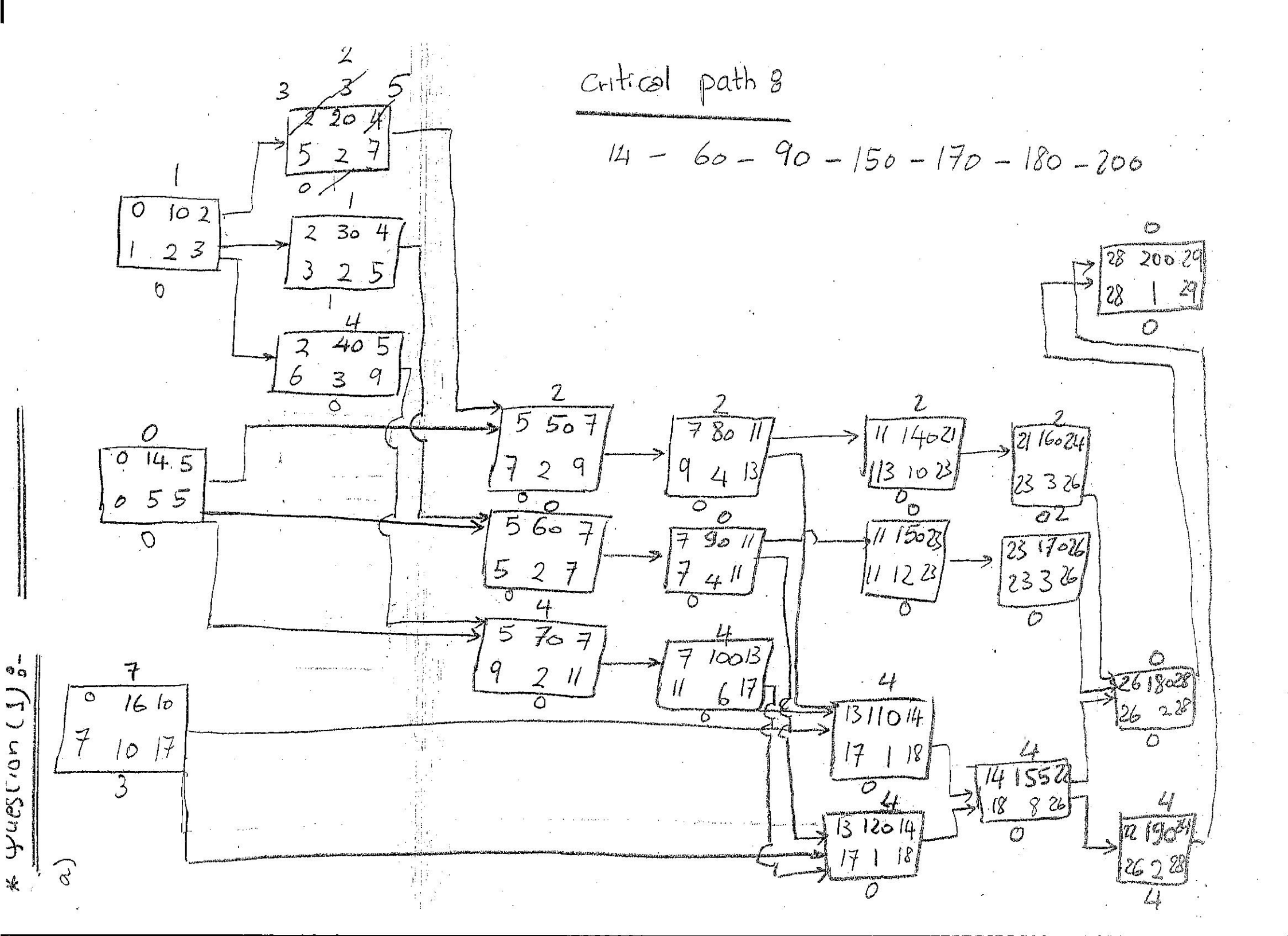
Activity Code	Depends on	Normal		Crash	
		Duration (Days)	Total Cost (L.E.)	Duration (Days)	Total Cost (L.E.)
A	None	3	876	2	1164
B	None	6	16454	4	16686
C	A	6	14231	4	14443
D	A, B	5	8592	4	8744
E	C	3	6490	3	6490
F	D	6	18670	4	18860
G	E, F	4	12886	3	19264
H	F	3	944	2	1168
I	G, H	4	3848	1	3986
J	H	4	7614	1	7814

uestion4)

You are the project manager of a small construction project having the following data:

- Project start date: January 1, 20xx
- Project finish date: August 31, 20xx
- Project budget: L.E. 400,000
- Data date: May 1, 20xx
- BCWP: L.E. 180,000 (up to April 30, 20xx)
- ACWP: L.E. 144,000 (up to April 30, 20xx)
- BCWS: L.E. 200,000

i) Assess the time and cost situation of your project.
ii) What is your decision if you know that there is a delay penalty of L.E. 120/day?


Critical path 8
14 - 60 - 90 - 150 - 170 - 180 - 200

b)

لاحظ أن الأنشطة الخاصة بال left Abutment هي :-

20 - 50 - 80 - 140 - 160

بعد تعديل بداية النشاط (20) لتصبح (3) بدلاً من (2)

يكون ال Total float لهذا المسار هو 2

* Question (2) :-

Note that :-

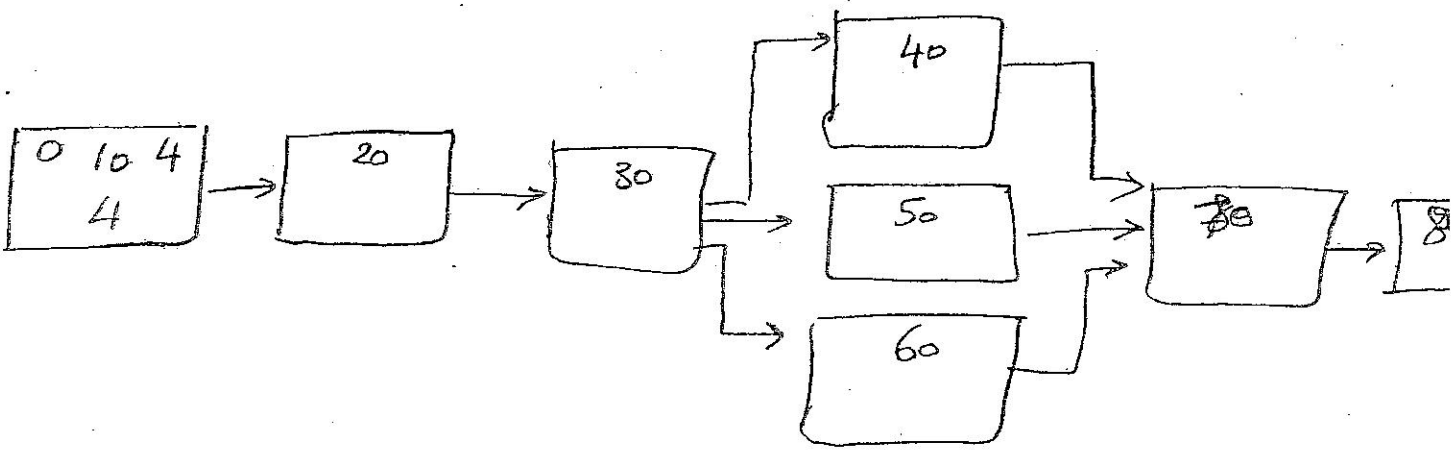
$$R = \text{Rate} = \frac{\text{No. of units}}{\text{Duration}} = \text{Const}$$

$$= \frac{12 \text{ unit}}{60 \text{ days}} = \frac{12 \text{ unit}}{10 \text{ weeks}}$$

$$= 1.2 \text{ unit/week}$$

$$= 0.2 \text{ unit/day}$$

Activity	predecessor	Duration (days)
10	—	$\frac{100}{4 * 8} = 3.125 \simeq 4$ days (4: crew size, 8: hrs/day)
20	10	4
30	20	2
40	30	2
50	30	2
60	30	2
70	40, 50, 60	2
80	70	2



* ACT (10) :

$R = 0.2$, $t_0 = 4$

$\therefore t_f = t_0 + \frac{N-1}{R}$

$= 4 + \frac{12-1}{0.2} = 59$

* ACT (20) :

$R = 0.2$, $t_0 = t_{0_{10}} + D_{20}$

$= 4 + 4 = 8$

$\therefore t_f = 8 + \frac{12-1}{0.2} = 63$

* ACT (30)

$t_0 = 8 + 2 = 10$

$t_f = 63 + 2 = 65$

ACT (40) :-

$t_o = 10 + 2 = 12$

$t_f = 65 + 2 = 67$

ACT (50) :-

$t_o = 10 + 2 = 12$

$t_f = 65 + 2 = 67$

ACT (60) :-

$t_o = 10 + 2 = 12$

$t_f = 65 + 2 = 67$

ACT (70) :-

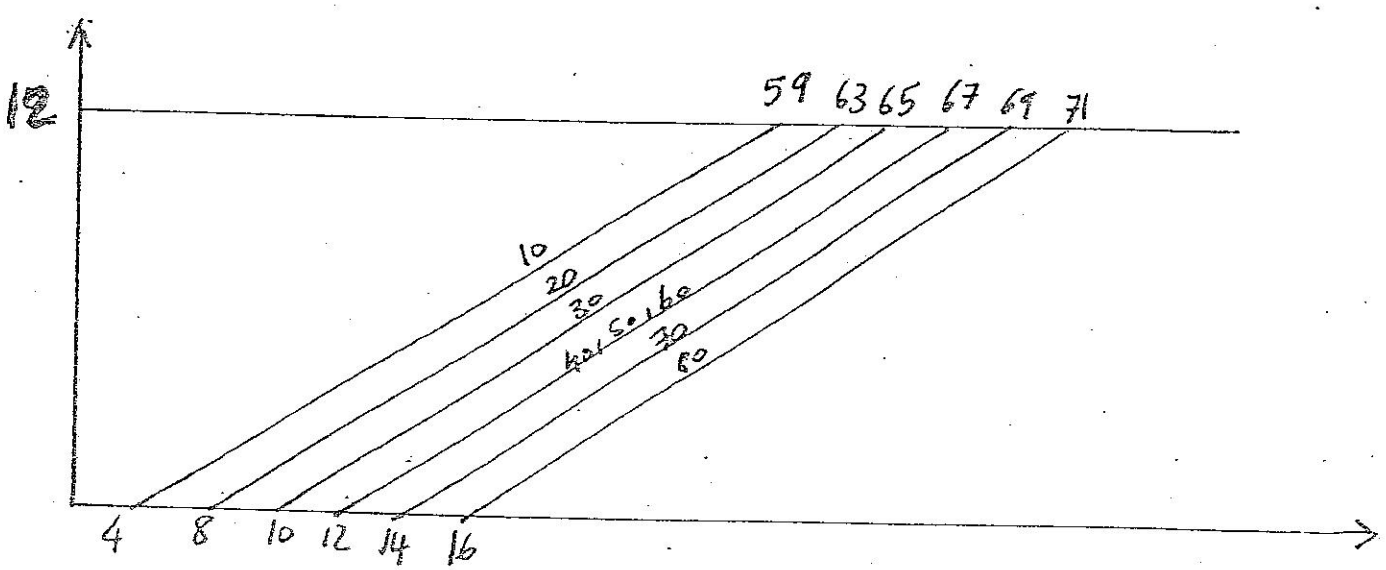
$t_o = 12 + 2 = 14$

$t_f = 67 + 2 = 69$

ACT (80) :-

$t_o = 14 + 2 = 16$

$t_f = 69 + 2 = 71$



∴ There is 4 teams to work upon 12 houses

∴ Team No. 1 will work upon Houses No. (1), (5), (9)

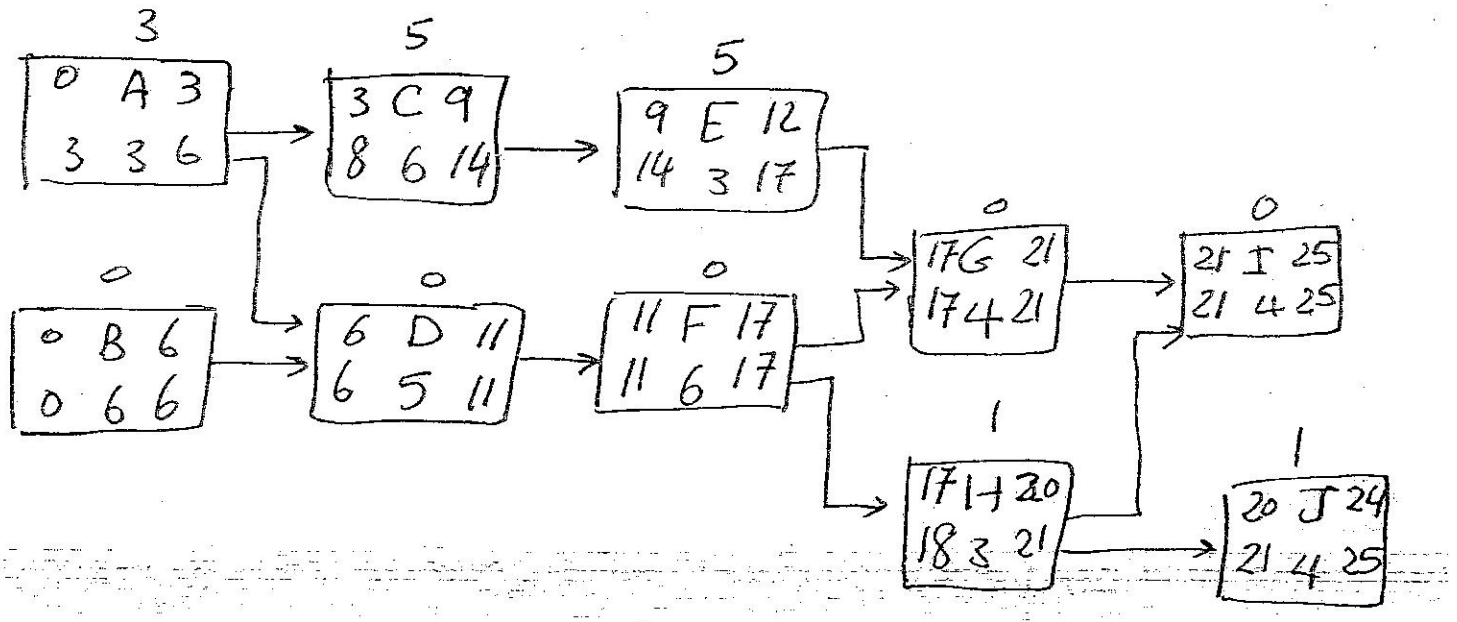
which means that the first team will leave the site after finishing House No. (9)

∴ $N = 9$, $R = 0.2$, $t_{o_{30}} = 10$

$$t_f = 10 + \frac{9-1}{0.2}$$

$$= \underline{\underline{50}} \text{ days}$$

* Question 10/6-



⇒ Total Normal Cost = 90,605 L.E

$$\text{Cost slope} = \frac{C_C - N_C}{N_D - C_D}$$

Act. code	Cost slope
A	288
B	116
C	106
D	152
E	~~2800~~ i.e: Not available
F	95
G	6378
H	224
I	46
J	66.67

A - C - E - G - I (20) ⇒ (19) ⇒ (19) ⇒ (17)

A - D - F - G - I (22) ⇒ (21) ⇒ (19) ⇒ (17)

A - D - F - H - J (24) ⇒ (24) ⇒ (22) ⇒ (20)

B - D - F - G - I (25) ⇒ (24) ⇒ (22) ⇒ (20)

B - D - F - H - J (24) ⇒ (24) ⇒ (22) ⇒ (20)

⇒ Trial NO : (1)

Crash ACT I by 1 day :

∴ Cost Increase = 1 x 46 = 46 L.E

⇒ Trial No : (2)

A + B = 288 + 116 = 404

D = 152

F = 95

H + G = 6378 + 224 كتب أووكى

I + J = 46 + 66.67 = 112.67

G + J = كتب أووكى

Crash ACT F by 2 days

∴ Cost Increase = 46 + 2 x 95 = 236 L.E

لاحظ أنه مش هينفع ننقص من F اللي هي استفزنا
2 days of crashing. الـ

⇒ Trial No (3):

Crash ACT (I+J) by 2 days

∴ Cost Increase = 236 + 2*112.67 = 461.34 L.

⇒ Trial No (4):

Crash ACT (D) by 1 day.

∴ Cost Increase = 461.34 + 1*152 = 613.34 L.

∴ Cost Increask percentage = $\frac{613.34 + 90,60}{90\,605}$

= 1.0067

which means 0.67% Increase

* Question (4) :-

(i) Schedule variance = S.V = B.C.W.P - B.C.W.S

= 180,000 - 200,000

= - 20,000

(behind schedule).

Cost variance = C.V = B.C.W.P - A.C.W.P

= 180,000 - 144,000

= + 36,000

(under run).

∴ T = estimated time at completion

$$= T_o \left[\frac{B.C.W.S}{B.C.W.P} \right]$$

$$= 8 \left[\frac{200,000}{180,000} \right] = 8.88 \text{ months.}$$

∴ C = estimated cost at completion.

$$= C_o \left[\frac{A.C.W.P}{B.C.W.P} \right] = 400,000 \left[\frac{144,000}{180,000} \right]$$

= 320,000 L.E

ii) Ass. 1 month = 30 days.

$$C_F = C + P(T - T_0)$$

$$= 320{,}000 + 120(8.88 - 8)(30)$$

$$= 323{,}168 \text{ L.E}$$

which is less than the project budget =

400,000 L.E

الفرقة الثالثة مدنى
المادة : ادارة المشروعات

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

STRUCTURAL ENGINEERING DEPARTMENT

3rd year civil eng. Dept. – Fall 2008

Jan., 2009 **Construction management** *Time : 2.0 Hrs*

Construction project Management

Answer the following questions

Assume any missing data with a reasonable numbers

Question (1)

Consider a simple construction project consists of two sequential activities A and B. Activities, normal and crash durations/costs are presented in the following table:

Activity	Duration (month)		Direct Cost (LE)	
	Normal	Crash	Normal	Crash
A	6	2	90000	120000
B	9	4	300000	340000

Calculate the optimum contract duration and the associated total cost considering that the charged indirect cost should be as 15000 LE per month .

Question (2)

For the following project:

a- Draw the arrow diagram

b- Draw the precedence network, and calculate the ES,EF, LS, LF, TF, and FF for each activity indicating the critical path.

Activity(i-j)	Activity code	Duration (week)
1-2	A	8
2-3	B	4
3-4	C	1
4-5	D	7
4-6	E	15
4-7	F	14
5-10	G	15
6-9	H	20
7-8	I	12
8-11	J	16
9-10	Dummy 1	0
9-11	Dummy 2	0
10-12	K	20
11-12	L	24
12-13	M	14
9-13	N	18

Question(3)

Using the data presented in the table below, it is required to reduce the project duration from 30 to 23 days with the minimum cost.

Activity	Preceding Act.	Durations (days)	Cost slope LE/day
A	-	3	-
B	-	4	950
C	-	5	1000
D	A,B	4	500
E	B,C	3	100
F	D,E	6	200
G	F	5	800
H	F	7	350
I	C	10	400
J	G,H,I	9	270

Question (4)

Using the data presented in the following table with the progress report at day 12 , it is required to :

a- Estimate the project duration, and show the critical path

b- Update this project and find the reduced network with the new critical path.

Activity	Preceding Act.	Durations (days)	Status at day 12
A	-	3	Completed
B	-	5	Completed
C	A	2	Completed
D	A	6	Completed
E	C	6	Its duration is 10
F	C,D	1	2 days are left
G	E	12	Can not start before working day 17
H	E,F	10	Its duration is 5
I	B,H	8	-
J	G	3	-

Question (5)

A big construction project consists of 37 units, the activities of each unit, their durations, dependences, and number of crews required, are shown in the following table.

Activities	Duration weeks	Predecessor	Number of crews required
A	4	-	2
B	10	A	4
C	12	A	6
D	8	B&C	4
E	9	C	4
F	6	A&C	4
G	4	D&E	8
H	5	F	3
I	4	G&H	4

It is required to :-

Task (1) – Draw the objective chart for this project

Task (2) - Draw the progress chart at week (16).

Task (3)-What is the minimum number of crews can be used for each of activities G and H with no effect on the total project duration

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

STRUCTURAL ENGINEERING DEPARTMENT

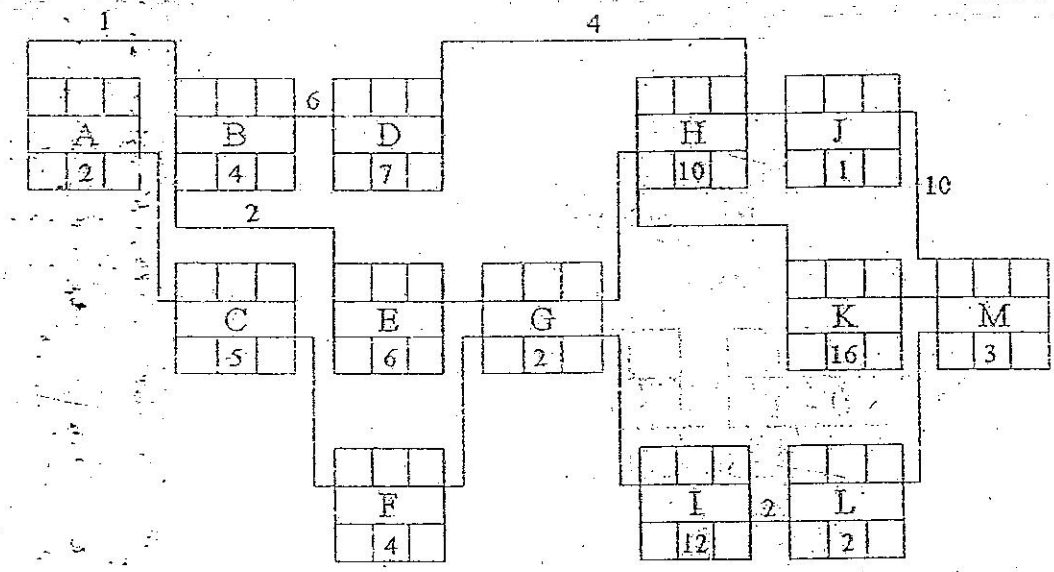
3rd Year Civil Eng. Dept. – Fall 2007

2, Jan., 2008 **Construction Project Management** *Time : 2.0 Hrs*

Answer the following 2 questions

Assume any missing data using reasonable numbers

Question no.1: Calculate the ES, LS, EF, LF, FF, TF, indicate the critical path and draw the time-scaled diagram for the networks shown below.



Question no.2: For the following 37-unit construction project, the network of one unit is shown below:

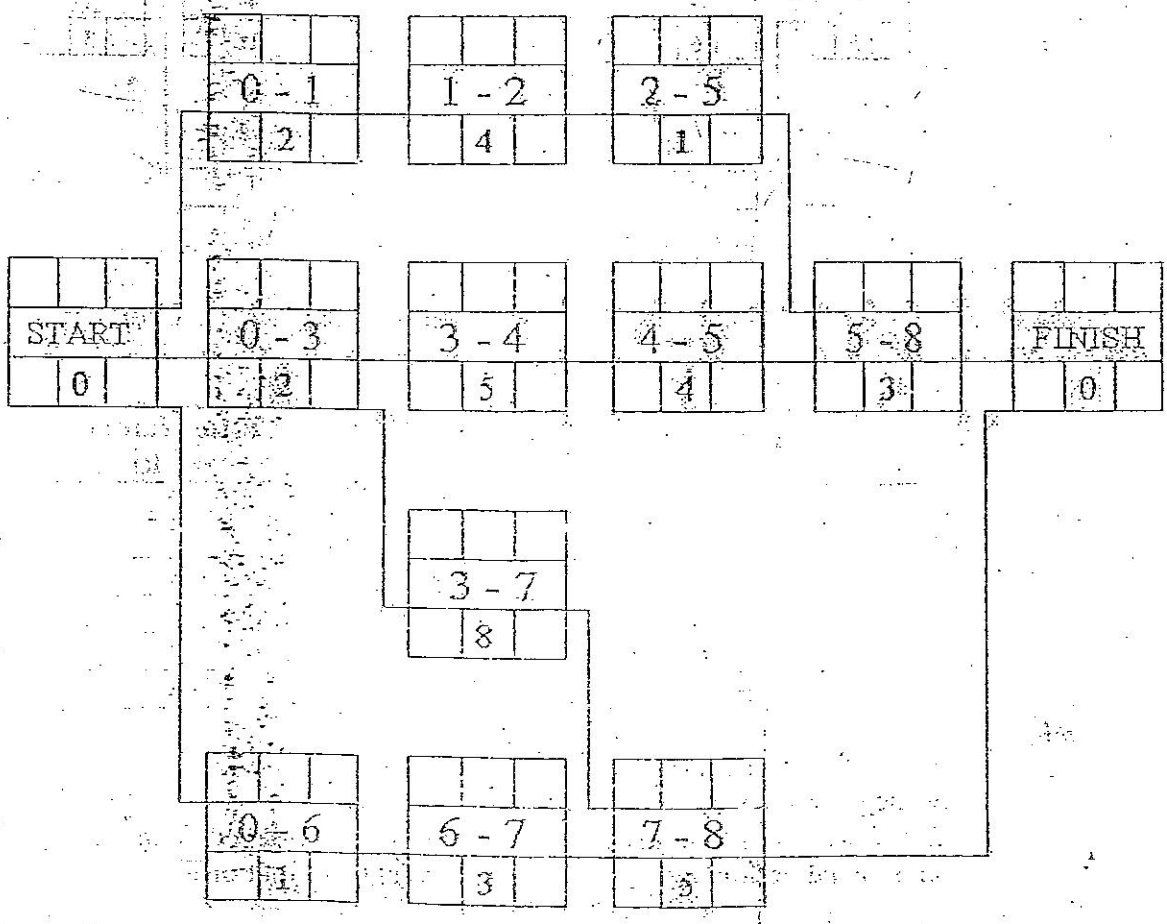
Activity	Depend on	Duration (week)	Rate (unit / week)
A		2	2
B	A	3	3
C	A	4	4
D	A	2	2
E	A,D,C	3	3
F	D,B,E	6	3

Required:

1- Draw the objective chart for the project and find its duration.
2- Draw the progress chart after 22 week.
3- If after 30 weeks of work the actual number of units finished from activity F is 15 units. What action would you take to correct this situation?

Question no.3: For the project shown in the following figure and the following revised list of resource requirements, using the bar-chart technique show that this set of resource requirements requires a 21 day project duration.

Activity	Resource Requirements		
	A	B	C
0 – 1	-	3	1
1 – 2	-	2	1
0 – 3	3	-	1
3 – 4	-	2	1
2 – 5	4	-	1
4 – 5	2	-	1
0 – 6	2	-	1
3 – 7	4	4	1
6 – 7	5	-	1
5 – 8	-	5	1
7 – 8	2	-	1
Max. Available	6	6	2



AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

STRUCTURAL ENGINEERING DEPARTMENT

3rd year Civil Eng. Dept. – Fall 2006

Dec., 2006 **Construction Management** *Time : 2.0 Hrs*

Construction Project Management

Answer the following (2) questions
Assume any missing data with reasonable figures

Question (1)

A large construction project consists of 13 units, the activities of each unit, their durations, dependences, expected costs, and the number of crews required are shown in the following table:

Activity	Duration (weeks)	Predecessor	Estimated direct cost per activity	Req. No. of crews per week	
				Normal	minimum
A	2	-	10000	4	4
B	3	A	12000	6	3
C	6	A	12000	18	18
D	5	A	15000	15	10
E	1	B&C	5000	3	3
F	6	D&E	18000	6	6

It is required to:-

Task (1) - Draw the Bar-Chart for this unit.

Task (2) - Draw the early time histogram for this unit.

Task (3) - Level the weekly crew requirement to no more than 36 crews per week, and draw the histogram for your solution.

Task (4) – Draw the cash flow diagram (Cash In and Cash Out) for the unit, if the indirect cost estimated as $1000 per week, and the profit margin is assumed to be 10%, and the periodic payments are received one month after billing.

Task (5) - Draw the arrow diagram for one unit.

Task (6) - Draw the precedence diagram for one unit.

Task (7) – Crash the duration of this unit by 3 weeks with the minimum cost.

Task (8) – Draw the objective chart for this project (13 units) according to the normal production rate

Task (9)- What is the minimum number of crews that can be used for activity E with no effect on the total project duration.

Question 2:

Calculate the direct and indirect costs for the concrete item for 12 bridge piers based on the following information:

1. Pier dimensions are in cm (200 width x 375 length x 750 height)
2. Material cost:
    a. wooden forms LE 50/m^2, waste 3%, 3 uses
    b. concrete LE 330/ m^3, waste 4%
3. Labor cost:
    a. Concrete crew LE 950/day
    b. Carpentary crew LE 1,250 per day
    c. Production rate for the concrete crew: 60 m^3/day; & Carpenters: 90 m^2/day
4. Equipment cost: LE 5,000 per day of concrete placement

Overhead rate: 18%
Tax rate: 16%
Profit rate: 15%

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