University Of Technology
Building and Construction Eng. Dept.
Final Exam –1st Attempt – 2013/2014

Subject :Management And Economic of Water Resources — Cass:4th Year

Branch : Dams and Water Eng. — Time : 3 Hours

Date : 4/ 6/ 2014

Answer Five Questions Only and the Marks are equally divided

Q1: Answer the followings:

A)What are the procedures which should be used to find the critical path in planning projects.

B)Explain the characteristics which should be considered in system analysis .

C)In the evaluation of water resources basin , special data must be collected . Explain them .

Q2: Three flood protections are to be allocated to avoid floods with unit of labors and materials as shown below:

Structures	Unit of Labors	Unit of Materials	Expected Protection
Reservoirs	2	3	300
Flood Plains	1	1	200
Levees	3	2	250
Available	25	50	----

Find the optimal protection by using simplex method .

Q3 : Two power stations are wanted to be used to supply energy. The function of cost in (BID) is given by the following relation:

$$C = 50A + 65B$$

where: (A , B) are the types of power stations.

This function is related to discharge , head of water , and the horsepower with the following restrictions:

1- The discharge used is not more than (6 CUMS) and the two types used (2 , 3) CUMS respectively.

2- The water head needed is not less than (16)m and the two types work on (6 , 8)m respectively.

3- The produced horsepower is not less than (90)HP and the two types product (45,50) HP respectively.

Formulate and solve the problem to find the minimum cost ..

Q4: : A dam project was planning to find the optimal construction program. The project was divided into several activities as shown in table below:

Activity	Period (month)		Activity	Period (month)
1-2	4		4-7	12
1-3	10		5-6	6
2-4	8		6-8	4
2-5	7		7-9	13
3-4	4		8-9	8
4-5	6		**********	

The restrictions in this estimations contains:

1- The activity (3-4) begins after completing the activity (1-2).

2- The activity (7-9) begins after completing the activity (5-6).

Draw the diagram of planning the project and find the critical path , the early and later beginning of each activity in the project.

Q5: The Government of town (L) want to supply it with water from source (A) . There are many pipe lines in the distance between them which are shown in table below :

Route		Cost	Route		Cost	Route		Cost
From	To	($)	From	To	($)	From	To	($)
A	B	800	B	F	500	H	K	200
B	E	300	C	E	500	E	G	200
A	C	700	J	L	400	G	J	200
B	D	400	D	H	400	E	H	200
C	D	600	G	I	100	H	I	600
C	F	300	D	G	800	F	H	400
F	G	200	G	K	400	H	J	300
K	L	800	I	L	600	--------	-------	-------

Draw the diagram of the suggested routes and find the route which gives the minimum cost .

Q6: The irrigation water is to be conveyed to agricultural land by three canals . The cost of the conveying in (BID) was related to the discharge passing across them as shown in the following equations:

$$C_1 = 105Q_1^{-1..5} \quad , \quad C_2 = 80Q_2^{-1.4} \quad , \quad C_3 = 120Q_3^{-1.3}$$

The restriction in this project that the total discharge must not exceed (100 CUMS) .

Find the optimal distribution in discharge of canals.

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Q-1

A-))

1- The project is divided into activities
2- The time for each activity will be estimated.
3- Find the sequence of each activity.
4- Draw the network drawing for the activities emplementation.
5- Find the routes that will be possible in the project and calculate its time of emplementation.
6- The critical path is the route of maximum time.

B-))

1- Sharpen the designes awarness the his objective.
2- Provided mechanisim and decesion.
3- Establish procedures for various solutions
4- Assemble optimization.

C-))

1- Agriculture: which contains:
   * Land classification.
   * Crop requirements.
2- Minicipal need: includes:
   * Industrial need.
   * Domestic need.
3- Hydropower: include:
   * Projected need
   * Alternative sources
4- Flood control: includes:

* Extend of damage
* Local storm requirements.

5- Navigation: Contains:
* Present of traffic Pattern
* Alternative sources.

6- Pollution: include:
* Existing condition
* Standand.

Q.2

let: X_1 = reservoir
X_2 = Flood plain
X_3 = levees.

$P = 300X_1 + 200X_2 + 250X_3$

subjected to:

$2X_1 + X_2 + 3X_3 \leq 25$

$3X_1 + X_2 + 2X_3 \leq 50$

$2X_1 + X_2 + 3X_3 + S_a = 25$

$S_a = 25 - 2X_1 - X_2 - 3X_3$

also $S_b = 50 - 3X_1 - X_2 - 2X_3$

	1	X_1	X_2	X_3
P	0	300	200	250
S_a	25	(-2)	-1	-3
S_b	50	-3	-1	-2

⇒

	1	S_a	X_2	X_3
P	3750	-150	50	-200
X_1	12.5	-0.5	(-0.5)	-1.5
S_b	12.5	-1.5	0.5	2.5

	1	S_a	X_1	X_3
P	5000	-200	-100	-350
X_2	25	-1	-2	-3
S_b	25	-2	-1	1

$\therefore X_2 = 25$ & $X_1 = 0$ & $X_3 = 0$

$P = 5000$, To check:

$P = 0 + 200 * 25 + 0 = 5000$

$\therefore$ O.K.

Q.3

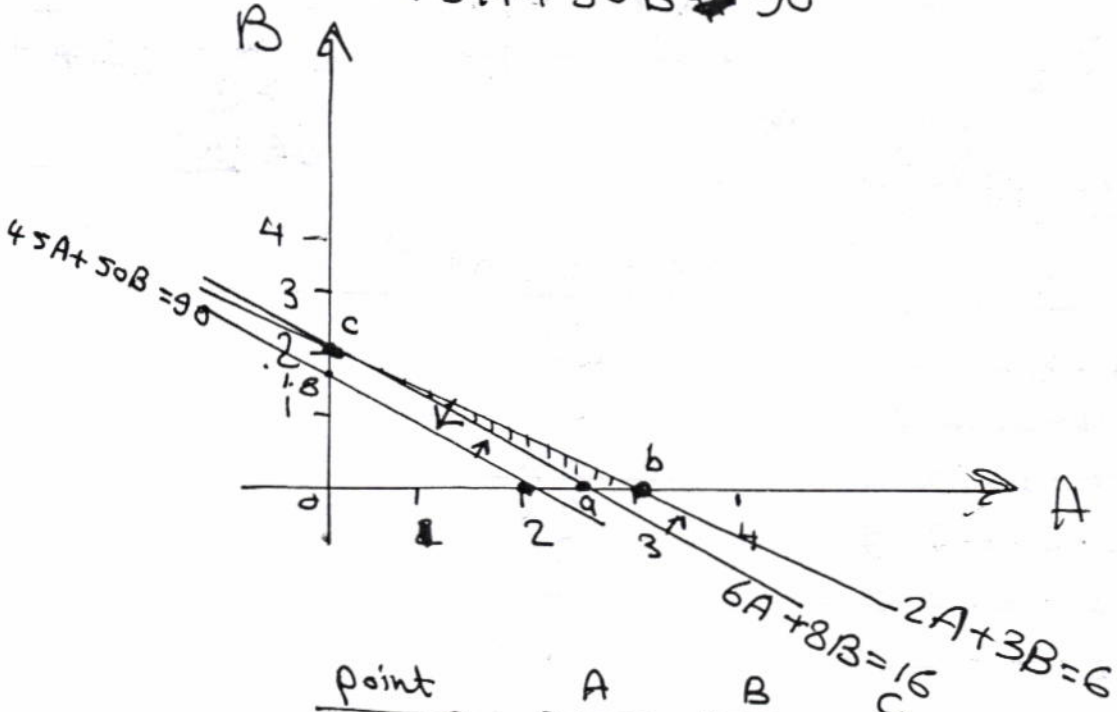
$C = 50A + 65B$

Subjected to:

$2A + 3B \leq 6$

$6A + 8B \geq 16$

$45A + 50B \geq 90$



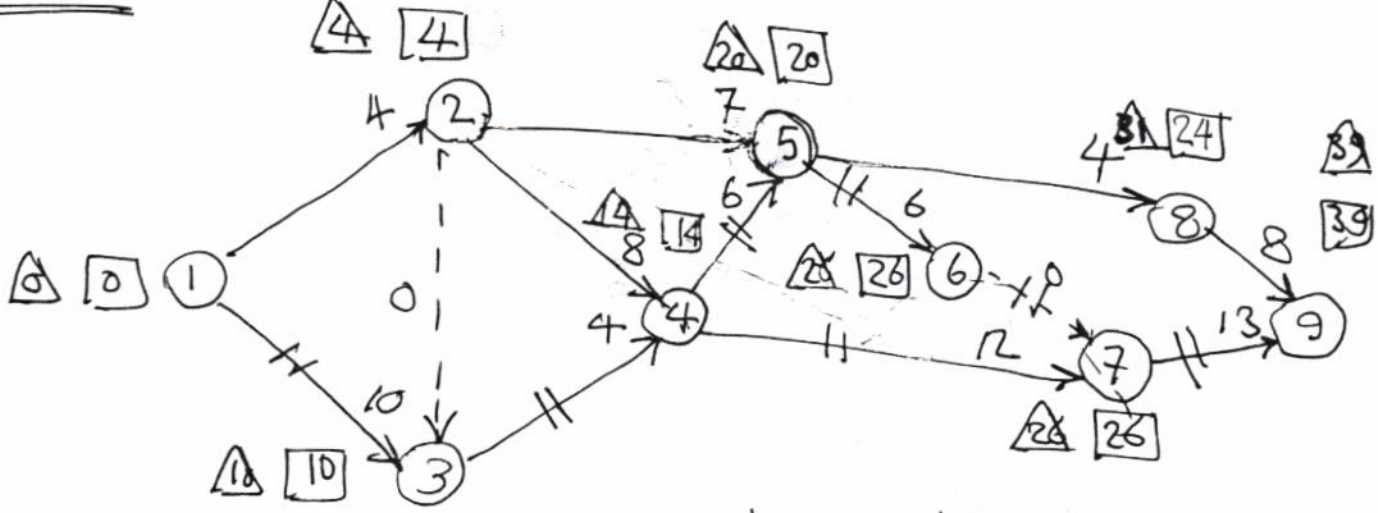
point	A	B	C
a	2.66	0	133
b	3	0	150
c	0	2	130

So min cost $C = 130$ BD

at $A = 0$

$B = 2$

Q-4



Path	Period (month)
1-2-5-8-9	23
1-2-4-5-8-9	30
1-2-4-7-9	37
1-2-4-5-6-7-9	30
1-2-5-6-7-9	30
1-2-3-4-7-9	33
1-2-3-4-5-8-9	26
1-2-3-4-5-6-7-9	33
1-3-4-7-9	39
1-3-4-5-8-9	32
1-3-4-5-6-7-9	39

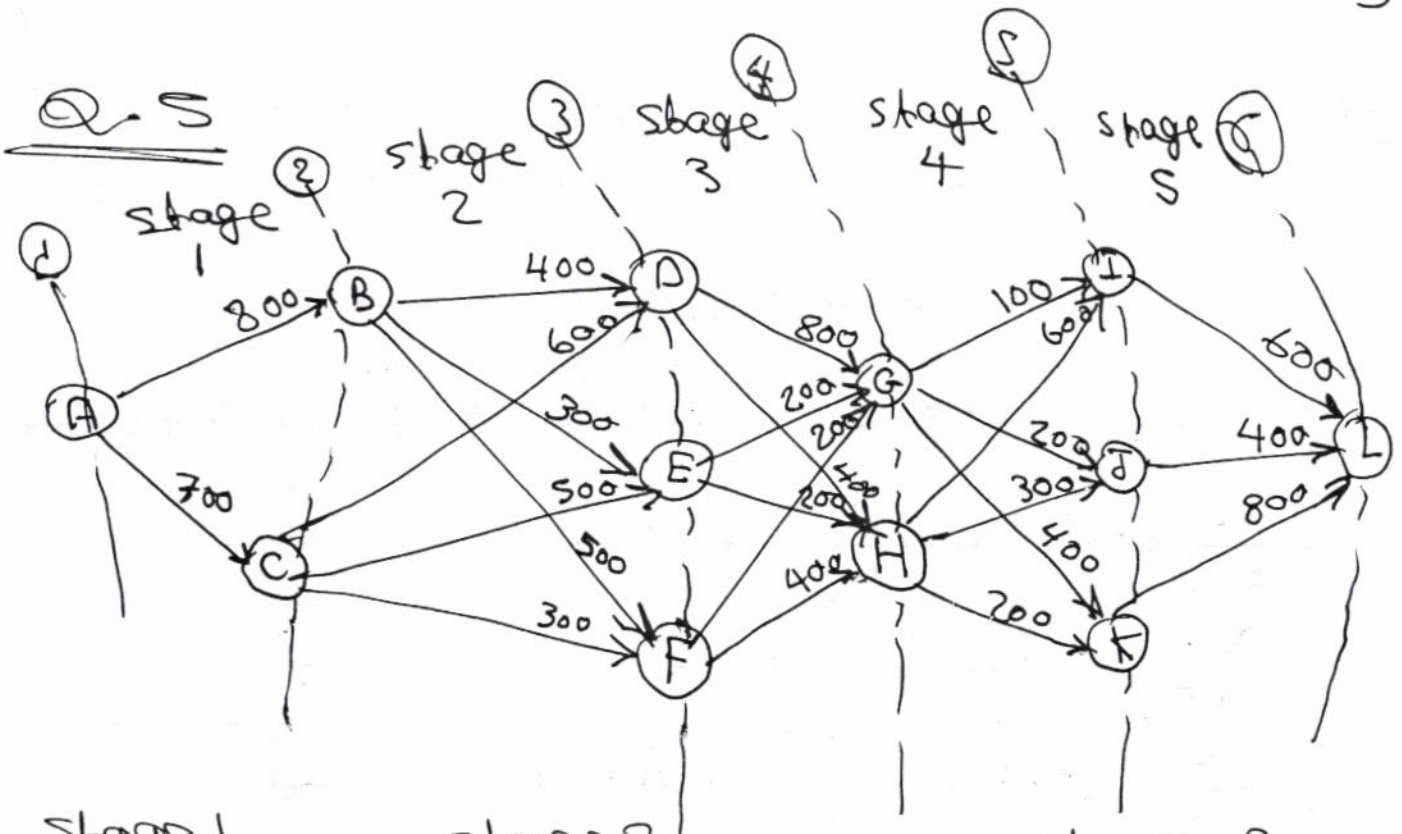
Two critical paths:

1-3-4-7-9

1-3-4-5-6-7-9

and their period is (39) months.

Q.5



stage 1

A → B 800
A → C 700

stage 2

B 1200 → D 1200
C 1300 →

B 1100 → E 1100
C 1200 →

B 1300 →
C 1000 → F 1000

stage 3

D 2000 →
E 1300 → G 1200
F 1200 →

D 1600 →
E 1300 → H 1300
F 1400 →

stage 4

G 1300 →
H 1900 → I 1300

G 1400 →
H 1600 → J 1400

G 1600 →
H 1500 → K 1500

stage 5

I 1900 →
J 1800 → L 1800
K 2300 →

The optimal route is : A → C → F → G → J → L
and its cost is (1800 $)

Q. 6

$$C = .105Q_1^{-1.5} + 80Q_2^{-1.4} + 120Q_3^{-1.3}$$

$$Q_1 + Q_2 + Q_3 = 100$$

$$C_\lambda = 105Q_1^{-1.5} + 80Q_2^{-1.4} + 120Q_3^{-1.3} + \lambda(Q_1+Q_2+Q_3-100)$$

$$\frac{\partial C}{\partial Q_1} = -157.5Q_1^{-2.5} + \lambda = 0 \quad \text{—— (1)}$$

$$\frac{\partial C}{\partial Q_2} = -112Q_2^{-2.4} + \lambda = 0 \quad \text{—— (2)}$$

$$\frac{\partial C}{\partial Q_3} = -156Q_3^{-2.3} + \lambda = 0 \quad \text{—— (3)}$$

$$\frac{\partial C}{\partial \lambda} = Q_1+Q_2+Q_3 - 100 = 0 \quad \text{—— (4)}$$

by solving the above equations,

$$Q_2 = 0.87Q_1^{1.04} \quad \text{—— (1)}$$

$$Q_3 = 0.995Q_1^{1.09} \quad \text{—— (2)}$$

$$Q_1 + 0.87Q_1^{1.04} - 0.995Q_1^{1.09} = 100$$

$$Q_1 = 30 \text{ m}^3/\text{sec}$$

$$Q_2 = 30 \text{ m}^3/\text{sec}$$

$$Q_3 = 40 \text{ m}^3/\text{sec}.$$