



B.E. (IT) Sem. – VIII (RC) Examination, June 2013
OPERATION RESEARCH (Elective – III)

Duration : 3 Hours

Total Marks : 100

- Instructions :** 1) Answer **any five** questions, choosing **atleast one full** question from **each** module.
2) Assume missing data, **if any**.

Module – I

1. a) What are the requirements for a linear programming problem ? 4
 b) Maximize $z = x_1 + 2x_2 + 3x_3 - x_4$,
 subject to the constraints $x_1 + 2x_2 + 3x_3 = 15$,
 $2x_1 + x_2 + 5x_3 = 20$,
 $x_1 + 2x_2 + x_3 + x_4 = 10$
 $x_1, x_2, x_3, x_4 \geq 0$. 16
2. a) Find the initial basic feasible solution of the following transportation problem by Vogel's approximation method 8

		Warehouse				Capacity
		W ₁	W ₂	W ₃	W ₄	
Factory	F1	19	30	50	10	7
	F2	70	30	40	60	9
	F3	40	8	70	20	18
Requirement		5	8	7	14	

- b) Find the optimal assignment for the assignment problem with the following cost matrix : 12

	I	II	III	IV
A	5	3	1	8
B	7	9	2	6
C	6	4	5	7
D	5	7	7	6



Module – II

3. a) Solve the following 0-1 integer LP problem using implicit enumeration

Maximize : $z = -3x_1 - 5x_2 - 3x_3$

Subject to : $x_1 + x_2 + x_3 \geq 1$

$-x_2 + x_3 \geq 1$

$x_1 - x_2 + 4x_3 \geq 5$

all $x_i = 0$ or 1 .

10

- b) Use Eastman’s algorithm to solve the traveling salesman problem with the following distance matrix :

10

From city	To city				
	1	2	3	4	5
1	∞	11	16	21	31
2	18	∞	21	21	19
3	22	25	∞	29	24
4	24	34	31	∞	18
5	17	18	31	23	∞

4. a) Solve the following integer programming problem using the cutting plane method

Maximize $Z = 5x_1 + 7x_2$

Subject to $-2x_1 + 3x_2 \leq 6,$

$6x_1 + x_2 \leq 30,$

$x_1, x_2 \geq 0$ and integers.

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- b) Explain the branch and bound algorithm to solve an assignment problem.

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Module – III

5. a) A drug manufacturing company has ten medical representatives working in three sales areas. The profitability for each representative in three sales areas is as follows :

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No. of representatives	0	1	2	3	4	5	6	7	8	9	10	
Profitability (thousands of rupees)	Area 1	15	22	30	38	45	48	54	60	65	70	70
	Area 2	26	35	40	46	55	62	70	76	83	90	95
	Area 3	30	38	44	50	60	65	72	80	85	90	85

- b) What are the distinguishing characteristics of dynamic programming problems ?

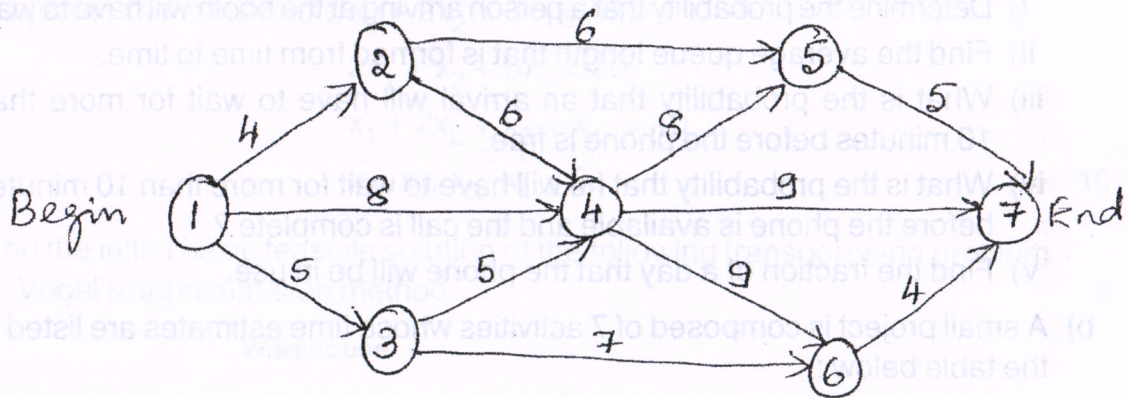
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6. a) A readymade garment manufacturer has to process seven items through two stages of production, cutting and sewing. The time taken for each of these items at the different stages is given below in appropriate units : 10

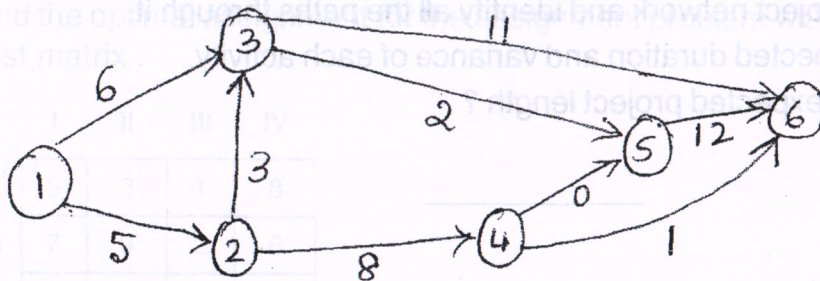
Item	:	1	2	3	4	5	6	7
Cutting Time	:	5	7	3	4	6	7	12
Sewing Time	:	2	6	7	5	9	5	8

- b) Use the concept of dynamic programming to find the maximum path through this network. 10



Module - IV

7. a) Determine the critical path for the project network in the below figure. All the durations are in days. 10





- b) A self service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can server 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service rate, find
- Average number of customers in the system.
 - Average number of customers in queue or average queue length.
 - Average time a customer spends in the system.
 - Average time a customer waits before being served.

10

8. a) Arrival rate of telephone calls at a telephone booth are according to Poisson distribution, with an average time of 9 minutes between two consecutive arrivals. The length of the telephone call is assumed to be exponentially distributed, with mean 3 minutes.
- Determine the probability that a person arriving at the booth will have to wait.
 - Find the average queue length that is formed from time to time.
 - What is the probability that an arrival will have to wait for more than 10 minutes before the phone is free.
 - What is the probability that he will have to wait for more than 10 minutes before the phone is available and the call is complete ?
 - Find the fraction of a day that the phone will be in use.

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- b) A small project is composed of 7 activities whose time estimates are listed in the table below :

Activity	1- 2	1- 3	1- 4	2- 5	3- 5	4- 6	5- 6
Optimistic time estimate	1	1	2	1	2	2	3
Most likely time estimate	1	4	2	1	5	5	6
Pessimistic time estimate	7	7	8	1	14	8	15

- Draw the project network and identify all the paths through it.
- Find the expected duration and variance of each activity.
- What is the expected project length ?

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b) What are the distinguishing characteristics of dynamic programming problems?