

Total No. of Questions : 12]

SEAT No. :

P814

[Total No. of Pages : 7

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B.E. (Mechanical-Sandwich)

b-OPERATIONS RESEARCH

(2008 Pattern) (Semester-I) (Elective-III) (Theory)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *All the questions are compulsory.*
- 2) *Two separate answer books are used for Section-I and Section-II.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is permitted.*
- 5) *Assume suitable data, if necessary.*

SECTION-I

Q1) a) Distinguish between Slack, Surplus and Artificial variable. **[6]**

b) Solve LPP by Suitable Method **[12]**

Maximize:

$$Z = X_1 - 3X_2 + X_3$$

Subject to:

$$3X_1 - X_2 + 2X_3 \leq 7$$

$$-2X_1 - 4X_2 \leq 12$$

$$-4X_1 + 3X_2 + 8X_3 \leq 10$$

Where, $X_1, X_2, X_3 \geq 0$

OR

Q2) a) Define following terms of Linear Programming: Basic Solution, Feasible Solution and Artificial Variables. **[6]**

b) Two products P_1 and P_2 are to be manufactured by a firm. Profits on P_1 and P_2 are Rs. 30 and 20 respectively. The products are to be processed on two machines, i.e., first on milling machine and other on surface grinder. The capacities and the time required to produce a unit are as follows:

P.T.O.

	P_1	P_2	Capacity
Milling machine	3 hours	1 hour	1500man hours/month
Surface machine	1 hour	1 hour	1000man hours/month

How many products of type P_1 and P_2 should be manufactured to get maximum profit (Use simplex method)? [12]

Q3) a) Explain with a suitable example 'Degeneracy in Transportation Problem'. [6]

b) Solve the following Transportation problem involving three sources and three destinations. The cell entries represent the cost of transportation per unit. Obtain the initial solution by VAM method and find optimal solution by MODI method. [10]

	I	II	III	IV	V	VI	Available
1	2	1	3	3	2	5	50
2	3	2	2	4	3	4	40
3	3	5	4	2	4	1	60
4	4	2	2	1	2	2	30
Required	30	50	20	40	30	10	180

OR

Q4) a) What is unbalanced assignment problem? How is it solved by the Hungarian Method? [6]

b) A company is faced with the problem of assigning six Machines to five different Jobs. The costs estimated in hundreds of rupees are given in the table below. Solve the problem assuming that the objective is to minimize the total cost. [10]

		Jobs				
		1	2	3	4	5
Machines	1	2.5	5	1	6	2
	2	2	5	1.5	7	3
	3	3	6.5	2	8	3
	4	3.5	7	2	9	4.5
	5	4	7	3	9	6
	6	6	9	5	10	6

- Q5) a)** Explain payback period method. [6]
- b) A company requires 16000 units of raw material costing Rs. 2 per unit. The cost of placing an order is Rs. 45 and carrying costs are 10% per year per unit of average inventory. Determine: [10]
- The economic order quantity.
 - Cycle time.
 - Total variable cost of managing the inventory.

OR

- Q6) a)** What is Dynamic programming? Explain procedure to solve problem by Dynamic programming. [6]
- b) There are five jobs, each of which must go through machines A, B and C in order ABC. Processing time (in hours) are given in the following table: [10]

Machines	Jobs				
	1	2	3	4	5
A	8	10	6	7	11
B	5	6	2	3	4
C	4	9	8	6	5

Determine the optimal sequence of jobs that minimizes the total elapsed time. Also find the idle time for the machines A, B and C.

SECTION-II

- Q7) a)** Explain how the theory of replacement is used in the following situations.
- i) Replacement of items whose maintenance cost varies with time.
 - ii) Replacement of item that completely fail. **[6]**
- b) Two breakfast food manufacturers ABC and XYZ are competition for an increased share. The pay off matrix the following table, describes the increase in market share for ABC and decrease in market share of XYZ. **[10]**

		XYZ			
		Give Coupons	Decrease Price	Maintain Present Strategy	Increase Advertising
ABC	Give Coupons	2	-2	4	1
	Decrease price	3	1	12	3
	Maintain Present Strategy	-6	2	0	6
	Increase Advertising	2	-3	7	1

Determine the optimal for both the manufacturers and the value of game.

OR

- Q8) a)** Explain how principle of dominance is used for simplifying solution of a rectangular game. **[6]**
- b) A company has option of buying one of two computers: ABC and XYZ. ABC costs Rs. 5 lakh and its running and maintenance costs are Rs. 60,000 for each of first five years, increasing by Rs. 20,000 in sixth and every subsequent year. XYZ has the same capacity as that of ABC but costs only 2.5 lakh. However its maintenance and running costs are 1,20,000 for first five years and increases by Rs. 20,000 per year thereafter. If the money is worth 10 percent per year, which computer should be purchased? What are the optimal replacement periods for each computer? Assume that there is no salvage value for either of computers. **[10]**

- Q9)** a) Discuss dynamic programming with suitable examples. Write step by step procedure to solve a general problem by dynamic programming approach. [4]
- b) Write short note on Integer programming. [4]
- c) A road transport company has one reservation clerk on duty at a time. He handles the information of bus schedules and makes reservations. Customers arrive at the rate of 8 per hour and the clerk can arrange, service 12 customers per hour. After stating your assumptions answer the following:
- i) What is the average number of customers waiting for the service?
- ii) What is the average time a customer has to wait before being served?

The manager is contemplating to install a computer system for handling information and reservations. This is expected to reduce the service time from 5 minutes to 3 minutes. The additional cost of having new system is Rs. 50/ day. If the cost of goodwill of having to wait is estimated to be 12 paise per minute spent waiting, before being served, should company install the computer system. Assume an 8 hour working day. [10]

OR

- Q10)**a) What is the concept involved in Gomory's cutting plane method. [4]
- b) Write a short note on various assumptions made in single channel queuing theory. [4]
- c) A plant has a large number of similar machines. The machines breakdown or failure is random and independent. The shift in-charge of the plant collected the data about various machines breakdown time required on hourly basis, and the record for the past 100 observations. This is shown in the table.

For each hour that one machine is down being, or waiting to be, repaired, the plant loses Rs. 70 by way of lost production. A repairman is paid at Rs. 20 per hour

- i) Simulate his maintenance system for 15 breakdowns.
- ii) How many repairman the company hire for the repair work.

Time between recorded machine breakdown (hours)	Probability
0.5	0.05
1	0.06
1.5	0.16
2	0.33
2.5	0.21
3	0.19

Repair time required (Hours)	Probability
1	0.28
2	0.52
3	0.20

Use the following random numbers

for breakdown time: 61, 85, 16, 46, 88, 08, 82, 56, 22, 49, 44, 33, 77, 87, 54

for repair time: 87, 39, 28, 97, 69, 87, 52, 52, 15, 85, 41, 82, 98, 99, 23

[10]

Q11) Consider the project having following activities and their time estimates: [16]

Job	A	B	C	D	E	F	G	H	I	J	K	L	M
Optimistic Time	3	4	5	9	4	3	5	1	2	7	4	8	6
Most likely Time	4	8	6	15	6	4	6	3	4	8	5	9	7
Pessimistic Time	5	10	8	10	8	5	8	4	5	10	6	13	8
Immediate Predecessors	–	–	B	A, C	B	D, E	D, E	D, E	G	F, I	G	H	J, K, L

- Draw the network for the project.
- Compute the expected project completion time.
- What should be the due date to have 0.9 probability of completion. Use $z = 1.29$.

Find the E & L values for all events.

OR
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Q12)a) Compare CPM and PERT. Under what conditions would you recommend the scheduling by PERT? Justify your answer with reasons. **[4]**

b) An insurance company has decided to modernize and refit one of its branch offices. Some of the existing office elements will be disposed of but remaining will be returned to the branch after the completion of renovation work. Tenders are invited from a number of selected contractors. The contractors would be responsible for all the activities in connection with the renovation work expecting the prior removal of the old equipment and subsequent replacement. The major element of project work has been identified along with its durations and immediately preceding elements.

Job	A	B	C	D	E	F	G	H	I	J	K	L	M
Time (Weeks)	14	4	2	1	2	3	2	4	3	12	4	2	2
Immediate Predecessors	–	A	B	C	A	E	E	E	H,L	K	D,F,G	J	H,L

- i) Draw the network showing interrelationship between activities of project.
- ii) Calculate minimum time required for project completion.
- iii) Locate the critical path. **[12]**

