Total No. of Questions : 12]

SEAT No. :

P3674

[Total No. of Pages : 8

[4959]-1040
B.E. (Mechanical)
OPERATIONS RESEARCH (Elective - II)
(2012 Course) (Semester - I) (402045 C)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data, if necessary.***

Q1) An industry is producing two jobs x and y. The manpower requirement per unit of the job x and y are 4 man hours and 3 man hours. The processing time needed per unit is expressed as 1 and 2 machine hours respectively. The raw material demand are as 0.3 and 0.2 kg per unit. The weekly availability of man hours, machine hours and raw materials are 100 man hour, 80 machine hour and 30 kg respectively. It is estimated that the profit per unit of x and y are as Rs. 5 and Rs. 3 respectively. Determine how much of jobs x and y are to be produced per week to maximize profit. Formulate the linear programming problem only. **[8]**

OR

Q2) a) Explain basic steps involved in construction of decision tree. **[4]**

b) Explain minimax principle and maximin principle. **[4]**

Q3) Solve the following transportation problem and use stepping stone method to test optimality of the solution. **[8]**

		Destination				
		D_1	D_2	D_3	D_4	Supply
Plant	I	2	3	11	7	6
	II	1	0	6	1	1
	III	5	8	15	9	10
Requirement		7	5	3	2	

OR

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Q4) A college is having a degree programme for which the effective semester time available is very less and the programme requires field work. Hence, a few hours can be saved from the total number of class hours and can be utilized for the field work. Based on past experiences, the college has estimated the number of hours required to each subject by each faculty.

The course in its present semester has 5 subjects and the college has considered 6 existing faculty members to teach these courses. The objective is to assign the best 5 teachers out of these 6 faculty members to teach 5 different subjects so that the total number of class hours required is minimized. The data of this problem is summarized as below. Solve the assignment problem optimally? **[8]**

		Subjects				
		1	2	3	4	5
Faculty	1	30	39	31	38	40
	2	43	37	32	35	38
	3	24	41	33	41	34
	4	39	36	43	32	36
	5	32	49	35	40	37
	6	36	42	35	44	42

Q5) A and B play a game in which each three coins, a 5 paise, 10 paise and 20 paise coins. Each player selects a coin without the knowledge of the other's choice. If the sum of the coins is an odd amount, A wins B's coins. If the sum is even, B wins A's coins. Find the optimal strategies for the players and the value of the game. **[6]**

			Player B		
			5	10	20
			I	II	III
Player A	5	I	–10	15	25
	10	II	15	–20	–30
	20	III	25	–30	–40

OR

Q6) Following figures related to the toy manufacturing company. **[6]**

Variable cost per unit = Rs. 8

Sales price per unit = Rs. 14

Total units sold = 50,000

Fixed cost = Rs. 12,000

Calculate

a) P/V ratio,

b) B.E.P. in units,

c) B.E.P. in sales,

d) Margin of Safety,

e) Total Profit.

Q7) a) The demand for an item in a company is 18000 units per year, and the company can produce the item at the rate of 3000 per month. The cost of one setup is Rs. 500 and the holding cost of one unit per month is 15 paise. The shortage cost of one unit is Rs. 240 per year. Determine the optimum manufacturing quantity and the number of shortages. Also determine the manufacturing time and the time between set-ups. **[8]**

b) The firm is considering the replacement of a machine, whose cost price is Rs. 12200 and the scrap value is Rs. 200. From experience the running costs are found to be as follows: **[6]**

Year	1	2	3	4	5	6	7	8
Running Cost (Rs.)	200	500	800	1200	1800	2500	3200	4000

When should machine be replaced?

OR

Q8) a) The pattern of the demand for the seasonal product is as follows: **[8]**

Demand (in units)	1	2	3	4	5	6	7	8
Probability	0.05	0.10	0.15	0.20	0.20	0.15	0.10	0.05

The cost of the product is Rs. 120 per unit and selling price is Rs. 150. How many units should be purchased for the season so as to maximize the expected profit? Also, if the salvage price of the product is Rs. 50 then would there be any change in the purchase decision?

b) The following normality rates have been observed for certain type of fuse: **[6]**

Week	1	2	3	4	5
Percentage failing by the end of the week	5	15	35	57	100

There are 1,000 fuses in use and it costs Rs. 5 to replace an individual fuse. If all fuses were replaced simultaneously it would cost Rs. 1.25. It is proposed to replace all fuses at fixed intervals of time, whether or not they have burnt out, and to continue replacing burnt out fuses as they fail. At what time intervals should the group replacement be made? Also prove that this optimal policy is superior to the straight forward policy of replacing each fuse only when it fails.

Q9) a) On an average 96 patients per 24 hour day require the service of an emergency clinic. Also on 10 minutes of active attention assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic Rs. 100 per patient treated to obtain an average service time of 10 minutes and that each minute decrease in this average time would cost Rs. 10 per patient treated. How much would have to be budgeted by the clinic to decrease the size of the queue from 1.33 to 0.5 patient? **[8]**

b) There are seven jobs, each of which has to go through two machines A and B in the order AB. The processing times in hours are as follows: **[8]**

Job	1	2	3	4	5	6	7
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

Determine the sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B.

OR

Q10)a) A typist in an office receives an average of 22 letters per day for typing. The typists work 8 hours per day and it takes on an average 20 minutes to type a letter. The company has determined that the cost of letter waiting to be mailed is 50 paise per hour and the equipment operating cost plus salary of typist is Rs. 40 per day. What is the total cost of waiting letters to be mailed? **[8]**

b) Find an optimal sequence for the following sequencing problem of four jobs and five machines, when passing is not allowed. Its processing time (in hours) is given below: **[8]**

Job	Machine				
	M1	M2	M3	M4	M5
A	7	5	2	3	9
B	6	6	4	5	10
C	5	4	5	6	8
D	8	3	3	2	6

Also find the total elapsed time?

Q11)a) An insurance company has decided to modernize and refit one of its branch offices. Some of the existing office equipment's will be disposed of but the remaining will be returned to the branch after the completion of the renovation work. Tenders are invited from the 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 its subsequent replacement. The major elements of the project have been identified, as follows along with their durations and immediately preceding elements. **[12]**

Activity	Description	Duration (weeks)	Immediate predecessors
A	Design new premises	14	-
B	Obtain tenders from contractors	4	A
C	Select the contractor	2	B
D	Arrange details with selected contractors	1	C
E	Decide which equipment is to be used	2	A
F	Arrange storage of equipment	3	E
G	Arrange disposal of the other equipment's	2	E
H	Order new equipment	4	E
I	Take delivery of new equipment	3	H,L
J	Renovations takes place	12	K
K	Remove old equipment for storage and disposal	4	D,F,G
L	Cleaning after the contractor has finished	2	J
M	Return old equipment for storage	2	H,L

i) Draw the network diagram between various activities of the project.

ii) Calculate the minimum time that the renovation can take from the design stage.

iii) Calculate the independent float that is associated with the non-critical activities in the network diagram.

b) Differentiate CPM and PERT. **[6]**

OR

Q12)a) A civil engineering firm has to bid for the construction of a dam. The activities and their time estimate are given as below: **[12]**

Activity	Optimistic	Most likely	Pessimistic
1-2	14	17	25
2-3	14	18	21
2-4	13	15	18
2-8	16	19	28
3-4 (dummy)	0	0	0
3-5	15	18	27
4-6	13	17	21
5-7 (dummy)	0	0	0
5-9	14	18	20
6-7 (dummy)	0	0	0
6-8(dummy)	0	0	0
7-9	16	20	41
8-9	14	16	22

The policy of the firm with respect to submitting is to bid the minimum amount that will provide a 95% of probability of at best breaking-even. The fixed costs for the project are eight lakhs and the variable costs are 9000 every day spent working on the project. The duration is in days and the costs are in rupees.

What amount should the firm bid under this policy?

b) Write a short note on (any one) **[6]**

i) Goal programming.

ii) Simulation

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