(Pages : 4)

MODEL QUESTION

Vth Semester B.Tech Degree Examination (2013 Scheme)

13.502: – OPERATIONS RESEARCH (N)

(INDUSTRIAL ENGINEERING)

Time: - 3 Hours **Maximum Marks: 100**

Answer all Questions from Part – A and any one full question from each module of Part - B

PART – A

1. Explain the four major assumptions of linear programming problems (L.P.P).
2. What are balanced and unbalanced transportation problem?
3. Explain Kendall Lee notations used to represent queuing models.
4. What is Bellman's principle of optimality with respect to dynamic programming?
5. Illustrate four major applications of operations research with example.

(5 X 4 = 20 Marks)

PART – B

Module - I

6. Write the dual of the following LPP
   Maximize $Z = 30X_1 + 23X_2 + 29X_3$
   Subject to
   $6X_1 + 5X_2 + 3X_3 \leq 26$
   $4X_1 + 2X_2 + 6X_3 \leq 7$ and all $X_j \geq 0$.
   Solve the dual by simplex method and read the solution to the primal from the final table.

7. Rice contains 6 units of vitamin A and 7 units of vitamin B per gram and costs 12 paise per gram. An egg contains 8 units of vitamin A and 12 units of vitamin B per gram and costs 20 paise per gram. The daily minimum requirement of vitamin A and vitamin B are 100 units and 120 units respectively. Find the optimal product mix.

Module - II

8. XYZ tobacco company purchases tobacco and stores in warehouses located in the following four cities:

Warehouse Location	Capacity (Tonnes)
City A	90
City B	50
City C	80
City D	60

(P.T.O)

The warehouses supply tobacco to cigarette companies in three cities that have the following demand:

Cigarette Company	Demand (Tonnes)
Bharat	120
Janata	100
Red Lamp	110

The following railroad shipping costs per tonne (in hundred rupees) have been determined:

Warehouse Location	Bharat	Janata	Red Lamp
A	7	10	5
B	12	9	4
C	7	3	11
D	9	5	7

Because of railroad construction, shipments are temporarily prohibited from warehouse at city A to Bharat Cigarette company.

a. Find the Optimum distribution for XYZ tobacco company.
b. Are there multiple optimum solutions? If yes, identify them.

9. A small airline company, owing five planes operates on all seven days of a week. Flights between three cities A, B, and C according to the schedule given below. The layover cost per stop is roughly proportional to the square of the layover time.

Flight No:	From	Departure Time (in Hrs)	To	Arrival Time (in Hrs)
1	A	09:00	B	12:00
2	A	10:00	B	13:00
3	A	15:00	B	18:00
4	A	20:00	C	Midnight
5	A	22:00	C	02:00
6	B	04:00	A	07:00
7	B	11:00	A	14:00
8	B	15:00	A	18:00
9	C	07:00	A	11:00
10	C	15:00	A	19:00

Find how the planes should be assigned to the flights so as to minimize the total layover cost. State any assumptions made

Module - III

10.

a) In a departmental store one cashier is there to serve the customers. And the customers pick up their needs by themselves. The arrival rate is 9 customers for every 5 minutes and the cashier can serve 10 customers in 5 minutes. Assuming Poisson arrival rate and exponential distribution for service rate, find: ***(P.T.O)***

i) Average number of customers in the system.
ii) Average number of customers in the queue or average queue length.
iii) Average time a customer spends in the system.
iv) Average time a customer waits before being served.

b) A branch of a nationalized bank has only one typist. Since typing work varies in length (number of pages to be typed), the typing rate is randomly distributed approximating a Poisson distribution with a mean service rate of 8 letters per hour. The letter arrives at a rate of 5 per hour during the entire 8- hour workday. If the typist is valued at Rs. 1.50 per hour, determine: (*a*) Equipment utilization, (*b*) The percent time an arriving letter has to wait, (*c*) Average system time, and d) Average idle time cost of the typewriter per day.

11. Mr. Sinha has to decide whether or not to drill a well on his farm. In his village, only 40% of the wells drilled were successful at 200 feet of depth. Some of the farmers who did not get water at 200 feet drilled further up to 250 feet but only 20% struck water at 250 feet. Cost of drillings is Rs. 50/- per foot. Mr. Sinha estimated that he would pay Rs. 18000/- during a 5-year period in the present value terms, if he continues to buy water from the neighbour rather than go for the well which would have life of 5 years. Mr. Sinha has three decisions to make: (*a*) Should he drill up to 200 feet? (*b*) If no water is found at 200 feet, should he drill up to 250 feet? (*c*) Should he continue to buy water from his neighbour? Draw up an appropriate decision tree and determine its optimal decision.

Module - IV

12. Two players P and Q play a game. Each of them has to choose one of the three colours, white (W), black (B) and red (R) independently of the other. Thereafter the colours are compared. If both P and Q have chosen white (W, W), neither wins anything. If player P selects white and player Q black (W, B), player P loses Rs.200/- or player Q wins the same amount and so on. The complete payoff table is shown below. Find the optimum strategies for P and Q and the value of the game.

Colour chosen by P		**Colour chosen by Q**		
		W	**B**	**R**
	W	0	-200	700
	B	200	500	600
	R	300	-300	800

13. The owner of a chain of four grocery stores has purchased six crates of fresh strawberries. The estimated probability distribution of potential sales of the strawberries before spoilage differs among the four stores. The following table gives the estimated total expected profit (in dollars) at each store, when it is allocated various numbers of crates

(P.T.O)

NO: of Crates	Stores			
	1	**2**	**3**	**4**
0	0	0	0	0
1	4	2	6	2
2	6	4	8	3
3	7	6	8	4
4	7	8	8	4
5	7	9	8	4
6	1	10	8	4

For administrative reasons, the owner does not wish to split crates between stores. However he is willing to distribute zero crates to any of his stores.

(4 X 20 = 80 Marks)

End of Question Paper