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DBI1357

Operational Research (New) (1240)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer **any two** subquestions from question no. 1, 3, 4 & 5.
5. Solve subquestions a, b or p, q from question no. 2.
6. Black figures to the right indicate full marks.
7. Non programmable electronic calculator is allowed.
8. Assume suitable data, if necessary.

UNIT - I

1. a) i) List various phases of operation research. 5
- ii) List and explain any five applications of operation research in large scale automobile industries. 5
- b) A company has two grades of inspectors 1 and 2 to undertake quality control inspection. At least 3500 pieces must be inspected in an 8 hours day. Grade 1 inspector can check 50 pieces in an hour with an accuracy of 95% Grade 2 inspector checks 25 pices an hour with an accuracy of 90%
The daily wages of grade 1 inspectors are Rs.6 per hour while those of grade 2 inspector are Rs. 5 per hour. Any error made by an inspector costs Rs. 4 per piece to the company. If there are, in all 20 grade 1 inspectors and 25 grade 2 inspector in the company, find the optimal assignment of inspectors that minimizes the daily inspection cost also find daily inspection cost. 10
- c) XYZ farms uses at least 800 kg of special feed daily. The special feed is a mixture of corn and soyabean meal with the following composition. 10

| Feed stuff | Protein | Fiber | Cost (Rs.) per kg |
|---------------|-----------------------|-------|----------------------|
| | (kg/kg of feed stuff) | | |
| Corn | 0.9 | 0.02 | 30 |
| Soyabean meal | 0.6 | 0.06 | 90 |

The dietary requirements of special feed are atleast 30% of protein and atmost 5% fiber. XYZ farms wishes to determine the daily minimum cost of feed mix.

UNIT - II

2. a) Find the dual of the following problems. 6
 objective function

Minimise $z = 6x_1 + 4x_2 + 6x_3 + x_4$
 Subject to constraints $4x_1 + 5x_2 + 4x_3 + 8x_4 = 21$
 $3x_1 + 7x_2 + 8x_3 + 2x_4 \leq 48$
 $x_1 \text{ to } x_4 \geq 0$

- b) Solve following LPP. 14
 Objective function

Minimize $z = 2x_1 - 4x_2 + 3x_3$
 Subject to $5x_1 - 6x_2 + 2x_3 \geq 5$
 $-x_1 + 3x_2 + 5x_3 \geq 8$
 $2x_1 + 5x_2 - 4x_3 \leq 4$
 $x_1, x_2, x_3 \geq 0$

OR

- p) What is infeasible solution ? How is it identified in the simplex tableau ? 6
- q) A jobbing shop has three machine groups, namely lathes, milling machines and grinding machines. It has idle capacity of 350 hours, 500 hours and 150 hours per week respectively. It is offered products A, B and C to be manufactured. Each unit of product A yields Rs. 30, product B Rs. 12 and product C Rs. 15. The time taken by each unit of the three products on different machines are given in tables below. 14

| Product \ m/c | Time in hours | | |
|---------------|---------------|---------|---------|
| | Lathe | Milling | Grinder |
| A | 5 | 9 | 3 |
| B | 4 | 3 | 0 |
| C | 0 | 5 | 2 |

- i) How much quantity of product A, B and C must be manufactured every week to yield maximum profit.
- ii) What capacity of each machine remains idle after making these products. State clearly the assumptions, if any made by you.

UNIT - III

3. a) i) What is 'transshipment problem' ? Explain with an example. 5
 ii) State the basic features of dynamic programming problems. 5

- b) A company has four factories F_1, F_2, F_3 and F_4 manufacturing the same product production and raw material costs differ from factory to factory and are given in the following table. The table also gives unit transportation cost from factories to sales depots S_1, S_2 and S_3 sales price, total requirement at each depot and production capacity of each factory are given below. 10

| | | F_1 | F_2 | F_3 | F_4 | Sales price / unit (Rs.) | Ragd. at Sales depot (units) |
|--------------------------------|-------|-------|-------|-------|-------|--------------------------|------------------------------|
| Production cost / unit (Rs.) | | 15 | 18 | 14 | 13 | | |
| Raw material cost / unit (Rs.) | | 10 | 9 | 12 | 9 | | |
| Transportation cost /unit | S_1 | 3 | 9 | 5 | 4 | 34 | 80 |
| | S_2 | 1 | 7 | 4 | 5 | 32 | 120 |
| | S_3 | 5 | 8 | 3 | 6 | 31 | 150 |
| Production capacity (units) | | 10 | 150 | 50 | 100 | | |

Determine the most profitable production and distribution schedule and the corresponding profit.

- c) A salesman has to visit four cities A, B, C and D. The distance (in hundred km) between each part of cities are as follows. 10

| From city | To city | | | |
|-----------|---------|---|---|---|
| | A | B | C | D |
| A | X | 4 | 7 | 3 |
| B | 4 | X | 6 | 3 |
| C | 7 | 6 | X | 7 |
| D | 3 | 3 | 7 | X |

If salesman starts from city A and has to come back to city A, visiting each city only once, Which route should be selected so that distance travelled by him is minimum ? What is the total distance travelled by him ?

UNIT - IV

4. a) A producer of boats has estimated the following distribution of demand for a particular kind of boat. 10

| No. of demand | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------|------|------|------|------|------|------|------|
| Probability | 0.14 | 0.27 | 0.27 | 0.18 | 0.09 | 0.04 | 0.01 |

Each boat costs him Rs. 7,000 and he sell them of Rs. 10,000 each. Any boats that are left unsold at the end of the season must be disposed of for Rs.6,000 each. How many boats should be in stock so as to maximize expected profit ?

- b) Two players A and B play a game of matching coins in which each has 3 coins; 10 paise, 25 paise and 50 paise coin. Each player selects a coin without knowledge of other player's choice. If the sum of the coins is even, A wins B's coin and if sum of the coins is odd, B wins A's coin. 10

- i) Prepare a pay off matrix.
- ii) Find the value of the game and strategies of each player.

c) A newspaper boy is thinking of selling a special one time edition of a sports magazine to his regular newspaper customers. Based on his knowledge of his customers, he believes that he can sell between 9 to 12 copies. The magazines can be purchased at Rs. 8 each and can be sold for Rs. 12 each. Magazines that are not sold can be returned to the publishers for a refund of 50% construct the decision matrix and determine the best decision from the stand point of :

- i) Maximin criteria
- ii) Laplace criteria
- iii) Hurwicz criteria assuming $\alpha = 0.4$.

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UNIT - V

5. a) i) What is the replacement problem ? When does it arise ?

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ii) A company have 4 jobs each of which has to go through the machines $M_j = 1, 2, \dots, 6$ in order M_1, M_2, \dots, M_6 processing time (in hrs) is given below.

5

| | | | | | | |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| m/c → Job ↓ | M ₁ | M ₂ | M ₃ | M ₄ | M ₅ | M ₆ |
| A | 18 | 8 | 7 | 2 | 10 | 25 |
| B | 17 | 6 | 9 | 6 | 8 | 19 |
| C | 11 | 5 | 8 | 5 | 7 | 15 |
| D | 20 | 4 | 3 | 4 | 8 | 12 |

Determine a sequence of these jobs that minimized the total elapsed time.

b) A machine shop has 4 machines A, B, C & D. Two jobs J₁ and J₂ must be processed through each of these machines. The time (in hrs) taken on each of the machines and necessary sequence of job through the shop are given below. Use graphical method to obtain the minimum elapsed time and idle time of each job.

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| | | | | | |
|----------------|---------------|---|---|---|---|
| J ₁ | Sequence Time | A | B | C | D |
| J ₂ | Sequence Time | D | B | A | C |
| | | 2 | 4 | 5 | 1 |
| | | 6 | 4 | 2 | 3 |

c) There are 1000 bulbs in the system. Survival rate is given below

| | | | | | |
|---------------------------------------|------|-----|-----|-----|----|
| Week | 0 | 1 | 2 | 3 | 4 |
| Bulbs in operation at the end of week | 1000 | 850 | 500 | 200 | 00 |

The group replacement of 100 bulb costs Rs. one and individual replacement cost Rs. 0.50 per bulb. Suggest a suitable replacement policy with replacement cost.

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