G 6040

M.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Second Semester

Apparel Technology and Management

AT 1653 — APPLIED OPERATIONS RESEARCH FOR MANAGEMENT

(Regulation 2005)

e : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

Define slack and surplus variables in LPP.

What is sensitivity analysis?

What is meant by an optimality test in a transportation problem?

ive the mathematical formulation of an assignment problem.

hat is meant by zero-one programming problem?

efine saddle point. Is it necessary that a game should always possess a saddle oint?

ate the "Principle of Optimality" in dynamic programming.

at do you mean by crash duration?

fine EVPI. How is it calculated?

ntion any four reasons for solving OR problems by simulation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A farm is engaged in breeding pigs. The pigs are fed on vario products grown on the farm. In view of the need to ensure certa nutrient constituents (say them X, Y and Z), it is necessary to b two additional products, say A and B. One unit of product contains 36 units of X, 3 units of Y and 20 units of Z. One unit product B contains 6 units of X, 12 units of Y and 10 units of Z. T minimum requirement of X, Y and Z is 108 units, 36 units a 100 units respectively. Product A costs Rs. 20 per unit a product B Rs. 40 per unit. Formulate the above as a lin programming problem to minimize the total cost, and solve t problem by using graphical method.

(ii) Using Simplex method, solve the following LPP :

Maximize $z = 4x_1 + 10x_2$

Subject to the constraints :

$$2x_1 + x_2 \leq 50$$
$$2x_1 + 5x_2 \leq 100$$
$$2x_1 + 3x_2 \leq 90$$
$$x_1 \geq 0 \text{ and}$$
$$x_2 \geq 0$$

Or

(b) In a product-mix problem x_1, x_2, x_3 and x_4 indicate the units of produ A, B, C and D respectively and have :

Maximize $z = 4x_1 + 6x_2 + 3x_1 + x_4$

Subject to :

$$1.5x_1 + 2x_2 + 4x_3 + 3x_4 \leq 550 \quad \text{(Machine I, hours)}$$
$$4x_1 + x_2 + 2x_3 + x_4 \leq 700 \quad \text{(Machine II, hours)}$$
$$2x_1 + 3x_2 + x_3 + 2x_4 \leq 200 \quad \text{(Machine III, hours)}$$
$$x_1, x_2, x_3, x_4 \geq 0$$

(i) Formulate the dual of the above problem

(ii) Solve the dual. From the solution of the dual, read the solutio the prime problem

(iii) If machine I remains out of order for 24 hours, what will be the to the manufacturer?

(iv) If the profit contribution from product A increases from Rs. Rs. 5 per unit, what will be the effect on optimal product mix?

12. (a) (i) Explain briefly

(1) North-west corner rule

(2) Minimum matrix method and

(3) Vogel's approximation method, for finding an initial basic feasible solution for a transportation problem. (12)

(ii) Discuss the 'Hungarian' method of solving an assignment problem. (4)

Or

(b) (i) A manufacturing company has four zones A, B, C, D and four sales engineers P, Q, R, S respectively for assignment. Since the zones are not equally rich in sales potential, it is estimated that a particular engineer operating in a particular zone will bring the following sales : Zone A : 4,20,000 Zone B : 3,36,000 Zone C: 2,94,000 Zone D : 4,62,000.

The engineers are having different sales ability. Working under the same conditions their yearly sales are proportional to 14, 9, 11 and 8 respectively. The criteria of maximum expected total sales is to be met by assigning the best engineer to the richest zone, the next best to the second richest zone and so on. Find the optimum assignment and the maximum sales. (12)

(ii) Distinguish between the time-minimization and cost-minimization transportation problems. (4)

(a) (i) What is integer linear programming? Explain the merits and demerits of "rounding off" a continuous optimal solution to an LPP to obtain an integer solution. (6)

(ii) A manufacturer of toys makes two types of toys A and D. Processing of these toys is done on two machines X and Y. Toy A requires two hours on machine X and six hours on machine Y. Toy B requires four hours on machine X and five hours on machine Y. There are 16 hours of time per day available on machine X and 30 hours on machine Y. The profit obtained on both the toys is same, that is Rs. 5 per toy. What should be the daily production of each of the two toys? (a non-integer solution for this problem will not be accepted.) (10)

Or

(b) (i) Consider a "modified" form of "matching biased coins" game problem. The matching player is paid Rs. 8.00 if the two coins turn both heads and Rs. 1.00 if the coins turns both tails. The non-matching player is paid Rs. 3.00 when the two coins do not match. Given the choice of being the matching or non-matching player, which one would you choose and what would be your strategy? (8)

(ii) Explain the Maximin and Minimax principle used in Game Theory. (4)

(iii) What are the properties of a game? Explain the "best strategy" on the basis of minimax criterion of optimality. (4)

14. (a) (i) Using dynamic programming, solve the following problem :

Minimize $z = y_1^2 + y_2^2 + y_3^2$

Subject to the constraints :

$y_1 + y_2 + y_3 \geq 15$ and $y_1, y_2, y_3 \geq 0$. (8)

(ii) Solve the following LPP by dynamic programming approach : (8)

Maximize $z = 2x_1 + 5x_2$

Subject to the constraints :

$$2x_1 + x_2 \leq 43$$
$$2x_1 \leq 46$$
$$x_1, x_2 \geq 0.$$

Or

(b) (i) Explain the following terms :

(1) Resource Smoothing and

(2) Resource Levelling (4)

(ii) Given below is the crew-size (manpower) requirements for each activity in a project.

Activity	Normal time (days)	Crew-size (Manpower required)
0 – 1	2	4
1 – 2	3	3
1 – 3	4	3
2 – 4	2	5
3 – 5	4	3
3 – 6	3	4
4 – 7	6	3
5 – 7	6	6
6 – 8	5	2
7 – 9	4	2
8 – 9	4	9

(1) Draw the network of the project activities.

(2) Re-arrange the activities suitably for reducing the existing total crew-size.

(3) If only 9 men are available for the execution of the project, the re-arrange the activities suitably for levelling the manpower resource. (12)

15. (a) (i) A steel manufacturing company is concerned with the possibility of a strike. It will cost an extra Rs. 20,000 to acquire and adequate stockpile. If there is a strike and the company has not stockpiled, management estimates an additional expenses of Rs. 60,000 on account of lost sales. Should the company stockpile or not if it is to use (1) Optimistic criterion (2) Wald criterion (3) Savage criterion (4) Hurwicz criterion for $\alpha = 0.4$ and (5) Laplace criterion. (10)

(ii) Explain the steps involved in Monte-Carlo simulation. (6)

Or

(b) (i) A businessman has two independent investments A and B available to him, but he lacks the capital to undertake both of them simultaneously. He can choose to take A first and then stop, or if A is successful then take B, or vice-versa. The probability of success on A is 0.7, while for B it is 0.4. Both investments require an initial capital outlay of Rs. 2,000 and both return nothing if the venture is unsuccessful. Successful completion of A will return Rs. 3,000 (over cost), successful completion of B will return Rs. 5,000 (over cost). Draw the decision-tree and determine the best strategy. (10)

(ii) Write short notes on the advantages, the applications, the limitations and the methodology of simulation. (6)
