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06CS/IS661

Sixth Semester B.E. Degree Examination, December 2011
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is operations research? Explain the impact of OR. **(06 Marks)**

b. A farmer has 100 acre farm. He can sell all tomatoes, lettuce, or radishes he can raise. The price he can obtain is ₹1.00 per kg for tomatoes, ₹0.75 a head for lettuce and ₹2.00 per kg for radishes. The average yield per acre is 2000kg of tomatoes, 3000 heads of lettuce and 1000kg of radishes. Fertilizer is available at ₹0.50 per kg and the amount required per acre is 100kg each for tomatoes and lettuce and 50kg for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man-days for tomatoes and radishes and 6 man-days fort lettuce. A total of 400 man-days of labour are available at ₹20.0 per man-day. Formulate this problem as a linear programming model to maximize the farmer's total profit. **(06 Marks)**

c. Old hens can be bought at ₹2 each and young ones at ₹5 each. The old hens lay 3 eggs per week and the young ones lay 5 eggs per week, each egg being worth 30 paise. A hen (young or old) costs ₹1 per week to feed. You have only ₹80 to spend for buying hens. How many of each kind should you buy to give a profit of more than ₹6 per week assuming that you cannot house more than 20 hens. Formulate the problem as an LPP and solve graphically. **(08 Marks)**

2 a. TOYCO assembles three types of toys – trains, trucks and cars, using three operations. The daily limits on the available times for the three operations are 430, 460 and 420 minutes respectively, and the revenues per unit of toy train, truck and car are \$3, \$2 and \$5 respectively. The assembly times per train at the three operations are 1, 3 and 1 minutes respectively. The corresponding times per truck and per car are (2, 0, 4) and (1, 2, 0) minutes (a zero time indicate that the operation is not used). Formulate the problem as LPP and solve using the simplex method. **(10 Marks)**

b. Explain the special cases that arise in the use of simplex method. **(10 Marks)**

3 a. Solve the problem, using the Big-M method.
Maximize $Z = 6x_1 + 4x_2$
Subject to constraints, $2x_1 + 3x_2 \le 30$; $3x_1 + 2x_2 \le 24$; $x_1 + x_2 \ge 3$; $x_1 \ge 0$; $x_2 \ge 0$
Find at least two solutions. **(10 Marks)**

b. Food X contains 6 units of vitamin A per gram and 7 units of vitamin B per gram and costs 12 paise per gram. Food Y contains 8 units of vitamin A per gram and 12 units of vitamin B per gram and costs 20 paise per gram. The daily minimum requirements of vitamin A and vitamin B are 100 units and 120 units respectively. Find the minimum cost of the product mix. Formulate the problem and solve using the two phase method. **(10 Marks)**

4 a. Use the revised simplex method to solve the following LPP:
Maximize $Z = 6x_1 - 2x_2 - 3x_3$
Subject to constraints, $2x_1 - x_2 + 2x_3 \le 2$; $x_1 + 4x_3 \le 4$; $x_1, x_2, x_3 \ge 0$. **(10 Marks)**

b. Obtain the dual solution directly, using the inverse from solution of the primal.
Maximize $Z = 5x_1 + 2x_2 + 3x_3$
Subject to constraints, $x_1 + 5x_2 + 2x_3 = 30$; $x_1 - 5x_2 - 6x_3 \le 40$; $x_1, x_2, x_3 \ge 0$. **(10 Marks)**

PART – B

5 a. Explain the parametric analysis with respect to change in c_j and b_j parameters. **(08 Marks)**

b. Obtain the optimal solution, using the dual simplex method for the dual problem of the following:
Maximize $Z = 3x_1 + 5x_2$
Subject to constraints, $x_1 \le 4$; $2x_2 \le 12$; $3x_1 + 2x_2 \le 18$; $x_1 \ge 0, x_2 \ge 0$. **(12 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

6 a. A department has five employees with five jobs to be performed. The time (in hours) each men will take to perform each job is given in the effectiveness matrix.

Jobs \ Employees	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

How should the jobs be allocated? One per employee, so as to minimize the total man hours. Use the Hungarian method. **(10 Marks)**

b. The following table shows all the necessary information on the availability of supply to each warehouse, the requirement of each market and unit transportation cost (in ₹) from each warehouse to each market.

Warehouse \ Market	P	Q	R	S	Supply
A	6	3	5	4	22
B	5	9	2	7	15
C	5	7	8	6	8
Demand	7	12	17	9	45

The shipping clerk has worked out the following schedule from experience. 12 units from A to Q, 1 unit from A to R, 8 units from A to S, 15 units from B to R, 7 units from C to P and 1 unit from C to R.

i) Check and see if the clerk has the optimal schedule.

ii) Find the optimal schedule and minimum total transport cost. **(10 Marks)**

7 a. Solve the game whose pay-off matrix to the player A is given in the table. **(10 Marks)**

A \ B	I	II	III
I	1	7	2
II	6	2	7
III	5	2	6

b. What is a decision tree? How a decision tree is constructed? Raman Industries Ltd. has a new product which they expect has great potential. At the moment they have two courses of action open to them. S_1 = To test the market and S_2 = To drop the product. If they test it, it will cost ₹50,000 and the response could be positive or negative with probabilities of 0.70 and 0.30 respectively. If it is positive, they could either market it with full scale or drop the product. If they market with full scale, then the result might be low, medium or high demand and the respective net pay-offs would be ₹100000, ₹100000 or ₹500000. These outcomes have probabilities of 0.25, 0.55 and 0.20 respectively. If the result of the test marketing is negative, they have decided to drop the product. If at any point, they drop the product, there is a net gain of ₹25,000 from the sale of scrap. All financial values have been discounted to the present. Draw a decision tree for the problem and indicate the most preferred decision. **(10 Marks)**

8 a. Consider the following Fig.Q8(a), where the dashed lines represent the potential links that could be inserted into the network and the number next to each dashed line represents the cost associated with inserting that particular link.

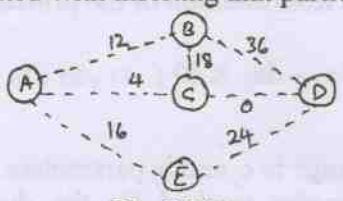

Fig.Q8(a)

Constraint 1 : No more than one of the three links AB, BC and AE can be included

Constraint 2 : Link AB can be included only of link BD also included.

Starting with the initial solution where the inserted links are AB, AC, AE and CD, apply the basic Tabu search algorithm to find the best solution. **(10 Marks)**

b. Write short notes on: i) Simulated annealing technique ii) Genetic algorithm. **(10 Marks)**

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