

ALCCS – (OLD SCHEME)

Code: CS42
Time: 3 Hours

Subject: OPERATIONS RESEARCH AND SYSTEM SIMULATION
Max. Marks: 100

MARCH 2011

NOTE:

- Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.
 - Parts of a question should be answered at the same place.
 - All calculations should be up to three places of decimals.
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- Q.1**
- a. Discuss the degeneracy in transportation problem.
 - b. Discuss the situation of multiple optimal solution problem in a simplex table.
 - c. Give the economic interpretation of complementary slackness theorem of duality.
 - d. What are the differences between assignment problem and transportation problem?
 - e. Discuss few reasons that motivate you to use simulation in solving O.R. problems.
 - f. Briefly discuss the integer programming problem and its different categories.
 - g. Discuss the characteristics of Dynamic programming problem. (7 × 4)

- Q.2**
- a. Describe in details the different scopes of application of Operations Research. (9)
 - b. Solve the following LP problem by dynamic programming approach
Maximize $Z = 8x_1 + 7x_2$
Subject to the constraints
 $2x_1 + x_2 \leq 8$
 $5x_1 + 2x_2 \leq 15$
and $(x_1, x_2) \geq 0$ (9)

- Q.3**
- a. What do you understand by Linear Programming Problem? What are the requirements of L.P.P? What are the basic assumptions of L.P.P? (9)
 - b. The ABC Printing Company is facing a tight financial squeeze and is attempting to cut costs wherever possible. At present it has only one printing contract and luckily the book is selling well in both the hardcover and paperback editions. It has just received a request to print more copies of this book in either the hardcover or paperback form. The printing cost for hardcover books is Rs 600 per 100 while that for paperbacks is only Rs. 500 per 100. Although the company is attempting to economize, it doesn't wish to lay off any employee. Therefore, it feels obliged to run its two printing presses obliged to run its two printing presses at least 80 and 60 hours

per week, respectively. Press I can produce 100 hardcover books in 2 hours or 100 paperback books in 1 hour. Press II can produce 100 hardcover books in 1 hour or 100 paperback books in 2 hours.

Determine how many books of each type should be printed in order to minimize costs. (9)

Q.4 a. Describe the economic importance of the Duality concept. (5)

b. Solve the following integer programming problem:

$$\text{Maximize } Z = 2x_1 + 20x_2 - 10x_3$$

Subject to the constraints

$$2x_1 + 20x_2 + 4x_3 \leq 15$$

$$6x_1 + 20x_2 + 4x_3 = 20$$

and x_1, x_2, x_3 are non-negative integers.

Solve the problem as a (continuous) LP problem, then show that it is impossible to obtain a feasible integer solution by using the method of simple rounding off. Solve the problem using any integer programming algorithm. (13)

Q.5 a. Suppose there are n -jobs for a factory and has n -machines to process the jobs. A job i ($i=1,2,\dots,n$) when processed by machine j ($j=1,2,\dots,n$) is assumed to incur a cost c_{ij} . The assignment is to be made in such a way that each job can associate with one and only one machine. Determine an assignment of jobs to machines so as to minimize the overall cost. Also discuss the assignment algorithm. (9)

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 Rs) from each warehouse to each market.

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

The shipping clerk has worked out of the following schedule from experience: 12 units from A to Q, 1 unit from A to R, 9 units A to S, 15 units from B to R, 7 units from C to P and 1 unit from C to R. (9)

Q.6 a. What is simulation? Discuss linear congruential generator (LCG) and Inverse transform method to generate pseudo-random number using a computer. (9)

- b. A bakery keeps stock of popular brand of cake. Previous experience shows the daily demand pattern for the item with associated probabilities, as given below:

| | | | | | | | |
|--------------------------|---|------|------|------|------|------|------|
| Daily demand (number) | : | 0 | 10 | 20 | 30 | 40 | 50 |
| Probability | : | 0.01 | 0.20 | 0.15 | 0.50 | 0.12 | 0.02 |

Use the following sequence of random numbers to simulate the demand for next 10 days.

Random numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49. (9)

- Q.7**
- a. What are the advantages and disadvantages of LPP? (6)
 - b. Discuss the branch and bound algorithm for integer programming problem. (6)
 - c. Discuss the Acceptance-Rejection Method for the generation of pseudo- random numbers. (6)