ROLL NO. ____________________

# ALCCS - OLD SCHEME

**Code: CS42** **Subject: OPERATIONS RESEARCH AND SYSTEM SIMULATION**
**Time: 3 Hours** **Max. Marks: 100**

## AUGUST 2011

**NOTE:**

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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 'Scope of Operations Research' in various fields of its application.

b. Define Simulation. List the advantages and limitations of simulation.

c. Explain the assumptions made for solving linear programming problems.

d. What are elements of transportation problem? Explain the general structure of transportation problems.

e. Explain the step by step procedure followed in "North West Corner Method" to obtain basic feasible solution.

f. Explain Knapsack problem with an example.

g. Explain the Hungarian Method used for solving assignment problems. **(7 × 4)**

**Q.2** a. List the principles of Modeling of O.R. problems. **(4)**

b. Solve the following LPP by graphical method

Maximize $Z = 10x_1 + 8x_2$

Subject to constraints $2x_1 + x_2 \leq 20$

$x_1 + 3x_2 \leq 30$

$x_1 - 2x_2 \geq -15$

$x_1, x_2 \geq 0$ **(14)**

**Q.3** a. Explain the concept of dual simplex method. **(4)**

b. A job shop makes three products A,B,C and demand for these products are 160, 120 and 140 units/week respectively. The products can be manufactured by one of the three methods I,II and III. The capacity of these methods are 90, 210 and 120 respectively. The profit in rupees/unit associated with each product and each method is given below. Determine the optimum method of manufacturing these products to maximize the profit. **(14)**

| Factories | A | B | C | Supply |
|---|---|---|---|---|
| M1 | 139 | 140 | 137 | 90 |
| M2 | 209 | 207 | 210 | 210 |
| M3 | 254 | 255 | 255 | 120 |
| Demand | 160 | 120 | 140 | 420 |

**Q.4** a. When linear programming problem is to be considered as integer programming problem?
Define (i) pure integer programming problem. (ii) mixed integer programming problem. (iii) pure (mixed) binary integer programming problem. **(6)**

b. Consider the following three-item knapsack problem:

| Item | Weight (wi) (per unit) | Value (vi) (per unit) |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 8 | 10 |
| 3 | 3 | 16 |

Given the capacity of a knapsack by weight *W*=10. Find a subset of items to be loaded into a knapsack in such a way that the total value of items loaded is maximized. Use forward computational procedure for this Dynamic Programming problem. **(12)**

**Q.5** a. Explain about cutting planes algorithm for solving Integer Programming problem. **(6)**

b. Consider the following integer program:

Maximize $7x_1+9x_2$

Subject to $-x_1+3x_2 \le 6$

$7x_1+x_2 \le 35$

$x_1, \quad x_2 \ge 0$ integer.

Explain the cutting plane approach to find the optimal integer solution. **(12)**

**Q.6** a. How to design a 'Simulation Experiment'? Explain. **(8)**

b. Solve the following Assignment problem. **(10)**

| Operations | Machines | | | |
|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ |
| $O_1$ | 10 | 15 | 12 | 11 |
| $O_2$ | 9 | 10 | 9 | 12 |
| $O_3$ | 15 | 16 | 16 | 17 |

**Q.7** a. A small retailer deals in a perishable commodity, the daily demand and supply of which are random variables. The past 500 days data show the following:

| Supply | | Demand | |
|---|---|---|---|
| Available ( kg ) | Number of Days | Demand (kg ) | Number of Days |
| 10 | 40 | 10 | 50 |
| 20 | 50 | 20 | 110 |
| 30 | 190 | 30 | 200 |
| 40 | 150 | 40 | 100 |
| 50 | 70 | 50 | 40 |

The retailer buys the commodity at Rs.20 per kg and sells at Rs.30 per kg. If any commodity remains at the end of the day, it has no resale value and is a dead loss. Moreover, the loss on any unsatisfied demand is Rs.8 per kg
Given the following random numbers. Simulate six day sales.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | 18 | 63 | 84 | 15 | 79 | 07 | 32 | 43 | 75 | 81 | 27 |

(Use the random numbers alternatively, for example, first pair (31) to simulate supply and second pair (18) to simulate demand, etc.) **(12)**

b. Write the Dual of the following LPP

Min $Z = 2x_2 + 5x_3$

$x_1 + x_2 \geq 2$

$2x_1 + x_2 + 6x_3 \leq 6$

$x_1 - x_2 + 3x_3 = 4$

and $x_1, x_2, x_3 \geq 0$ **(6)**