ALCCS

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

SEPTEMBER 2010

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.**

Q.1   a. Define Linear function and linear inequalities. What do we understand by a linear programming problem?

b. List and explain the assumptions of linear programming problem.

c. Relationship between the primal problem and the dual problem.

d. Distinguish between integer programming problem and linear programming problem. Give examples?

e. Define simulation and its advantages.

f. Discuss the degeneracy in transportation problem.

g. Discuss the complication arises due to unrestricted variables in a Linear Programming problem.   **(7 × 4)**

Q.2   a. Establish the difference between
   (i)   Feasible solution
   (ii) Basic Feasible Solution
   (iii) Degenerate Basic Feasible Solution
   (iv) Optimum Basic Feasible Solution
   (v)   Explain the significance of shadow price.   **(9)**

   b. Discuss the components of a simplex tableau. Obtain the dual problem of the following L.P.P.

   Maximize $z = 2x_1 + 5x_2 + 6x_3$
   Subject to the constraints
   $$5x_1 + 6x_2 - x_3 \leq 3$$
   $$-2x_1 + x_2 + 4x_3 \leq 4$$
   $$x_1 - 5x_2 + 3x_3 \leq 1$$
   $$-3x_1 - 3x_2 + 7x_3 \leq 6$$
   $$(x_1; x_2; x_3) \geq 0$$

   (9)

Q.3   a. Discuss transportation problem with suitable examples. Also discuss the assignment problem in
   brief.

   (9)

b. A departmental head has four subordinates, and four tasks to be performed. The subordinates differ in efficiency, and tasks differ in their intrinsic difficulty. His estimate of the time each man would take to perform each task is given in the matrix below: **(9)**

Tasks	Men			
	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

How should the tasks be allocated one to a man so as to minimize the total man hours?

Q.4   a. What is revise simplex method? Discuss the advantages of Revised Simplex Method over the ordinary simplex method.   **(9)**

b. Use revised simplex method to solve the L.P.P.,

maximize $z = 3x_1 + 2x_2 + 5x_3$
subject to the constraints

$x_1 + 2x_2 + x_3 \leq 430$
$3x_1 + 2x_3 \leq 460$
$x_1 + 4x_2 \leq 420$
$(x_1, x_2, x_3) \geq 0$ **(9)**

Q.5   Briefly discuss the dynamic programming problem. Define the principle of optimality of dynamic programming approach and discuss the dynamic programming algorithm.   **(9)**
Use dynamic programming to solve the following L.P.P.

Maximize $z = 3x_1 + 5x_2$
subject to

$x_1 \leq 4$

$x_2 \leq 6$

$3x_1 + 2x_2 \leq 18$

and $(x_1; x_2) \geq 0$

Q.6   Discuss the various steps involved in simulation process.
Dr. Dilip is a dentist who schedules all his patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time actually to complete the work:

Category	Time Required (minutes)	Probability of category

Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Checkup	15	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8:00 A.M. Use the following random numbers handling the above problem.

40   82   11   34   25   66   17   79   **(9)**

Q.7   Write short note on:

(i)   Monte-Carlo Simulation Method
(ii)   Properties of Gomery's cutting plane method and the steps involved to solve Integer Linear Programming Problem.
(iii) Distinguish between simulation and modeling.   **(6+6+6)**