ROLL NO. _____

Code: CS42 Subject: OPERATIONS RESEARCH AND SYSTEM SIMULATION

ALCCS - OLD SCHEME

Time: 3 Hours **FEBRUARY 2013** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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. Describe briefly the different Operations Research techniques.

b. What are the basic assumptions of linear programming problems?

c. Show that for a L.P.P., dual of the dual is the primal.

d. Explain North West corner rule for obtaining initial basic feasible solution for a transportation problem.

e. What are the applications of integer programming problems?

f. What is dynamic programming problem and also state Bellman's principle of optimality.

g. Explain the areas of application of Monte-Carlo simulation. Also state its limitations. **(7×4)**

Q.2 a. Explain different phases in an Operations Research study. Explain the role of computers in this field. **(8)**

b. A company makes two kinds of fertilizers, called Hi-phosphate and Lo-phosphate. Three basic raw materials are used in manufacturing these fertilizers in this manner:

Raw Material	Tons of raw material required to manufacture one ton		Maximum amount of raw material available per month
	Hi-Phosphate	Lo-Phosphate	
1	2	1	1500
2	1	1	1200
3	1	0	500
Selling price per ton of fertilizer	$15	$10	

How much of each fertilizer should the company manufacture to maximize its gross monthly sales revenue? Formulate this as a linear programming problem and solve by simplex method. **(10)**

Q.3 a. Give the mathematical formulation of the assignment problem and explain the method of solving a maximization assignment problem. **(6)**

b. Given the following transportation problem:

Warehouses	**A**	**B**	**C**	**D**	**E**	**F**	Availability
X	1	2	1	4	5	2	600
Y	3	3	2	1	4	3	500
Z	4	2	5	9	6	2	750
Requirements	200	400	300	200	400	370	

Obtain the initial basic feasible solution using Vogel's approximation method and hence find optimum solution using MODI method. **(12)**

Q.4 a. Write short notes on the following:
(i) Economic interpretation of duality in linear programming.
(ii) Sensitivity Analysis for Linear Programming. **(8)**

b. Solve the following problem using dynamic programming approach. A 4-ton vessel can be loaded with one or more of three items. The following table gives the unit weight, w_i, in tons and the unit revenue in thousands of dollors, r_i, for item i. How should the vessel be loaded to maximize the total return? **(10)**

Item i	W_i	r_i
1	2	31
2	3	47
3	1	14

Q.5 a. Explain the Revised Simplex Method for solving LPP. **(6)**

b. Using Branch and Bound algorithm, solve the following integer linear programming problem:

Maximize : $Z = 7x_1 + 9x_2$

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

$7x_1 + x_2 \leq 35$

$x_2 \leq 7$

$x_1, x_2 \geq 0$ and are integers. **(12)**

Q.6 a. What are the features to be considered while building a simulation model? Explain basic steps needed to make a simulation study. **(12)**

b. Discuss the Acceptance-Rejection Method for the generation of pseudo-random numbers. **(6)**

Q.7 a. Justify the use of simulation technique in queuing systems. Also, describe the simulation study of a single-server queue system. **(8)**

b. Write short note on the following:
(i) Box-Muller Transformation for generating a sample from standardized normal distribution.
(ii) Discrete-system simulation languages. **(10)**