B.Sc. (Honours) Semester-VI Examination 2017
Computer Science
Course : BCSE-63
(Operations Research)

Time : 3 Hours **Full Marks : 40**

Questions are of value as indicated in the margin

Answer Question No.1 and **any four** from the rest.

1. (a) What are the advantages and limitations of LP models?
   (b) What conditions must exist in a simplex table to establish the existence of an alternative solution, no feasible solution, unbounded solution and degeneracy?
   (c) What is the meaning and the role of the lower bound and upper bound in the branch and bound method?
   (d) What is the essential difference between regular simplex method and dual simplex method? 4×2=8

2. (a) How does dynamic programming conceptually differ from linear programming?
   (b) Illustrate the method for solving a linear programming problem by the dynamic programming approach.
   (c) Using dynamic programming solve :
   Maximize $Z = u_1^2 + u_2^2 + u_3^2$
   Subject to the constraints:
   $$u_1 \cdot u_2 \cdot u_3 = 6$$
   and $u_1, u_2, u_3 \geq 0$ and integers. 2+2+4=8

3. (a) State the various steps involved in the dual simplex algorithm.
   (b) Use dynamic programming to solve the following LPP:
   Max $Z = 50x_1 + 100x_2$
   Subject to the constraints:
   $$2x_1 + 3x_2 \leq 48$$
   $$x_1 + 3x_2 \leq 42$$
   $$x_1 + x_2 \leq 21$$
   and $x_1, x_2 \geq 0.$ 4+4=8

4. (a) Use the principle of optimality to solve the problem
   Min $Z = \sum_{j=1}^{n} x_j^{\alpha}$
   Subject to the constraints:
   $$x_1 . x_2 . \cdots . x_n = r$$
   and $x_j \geq 0$ for $j = 1, 2, ..., n, r \geq 1$ and $\alpha > 0.$

P.T.O.

(b) Use dual simplex method to solve the following LPP :

$$\text{Min } Z = x_1 + 2x_2 + 3x_3$$

Subject to the constraints:

$$x_1 - x_2 + x_3 \geq 4$$
$$x_1 + x_2 + 2x_3 \leq 8$$
$$x_2 - x_3 \geq 2$$

and $x_1, x_2, x_3 \geq 0$ 4+4=8

5. (a) A manufacturer produces electric hand saws and electric drills, for with the demand exceeds its capacity. The production cost fo a saw is Rs 6 and drill is Rs 4. The shipping cost is 20 paise for a saw and 30 paise for a drill. A saw sells for Rs 9 and a drill sells for Rs 5.50. The budget allows a maximum of Rs 2400 for production costs and Rs 120 for shipping costs. Formulate this problem as an LP model and solve it to determine the number of saws and drills that should be produced in order to maximize the excess of sales over production and shipping costs.

(b) Solve the following LPP by generating its dual:

$$\text{Max } Z = 3x_1 + x_2 + 2x_3 - x_4$$

Subject to the constraints:

$$2x_1 - x_2 + 3x_3 + x_4 = 1$$
$$x_1 + x_2 - x_3 + x_4 = 3$$

and $x_1, x_2 \geq 0$ and x_3, x_4 unrestricted in sign. 4+4=8

6. (a) Write down all the rules for constructing dual from primal. Give an example to illustrate this.

(b) Solve the following ILP:

$$\text{Max } Z = 2x_1 + 3x_2$$

Subject to the constraints :

$$x_1 + 3x_2 \leq 9$$
$$3x_1 + x_2 \leq 7$$
$$x_1 - x_2 \leq 1$$

and $x_1, x_2 \geq 0$ (3+1)+4=8

7. (a) Describe two-phase method to solve an LPP.

(b) Apply the above method to solve the following problem :

$$\text{Min } Z = 2x_1 - 3x_2$$

Subject to the constraints:

$$x_1 - 3x_2 \geq 3$$
$$2x_1 + 3x_2 \geq 10$$
$$3x_1 + x_2 \geq 5$$

and $x_1, x_2 \geq 0.$ 4+4=8

———————