# GUJARAT TECHNOLOGICAL UNIVERSITY
## B. E. Sem-VI Examination May 2011

### Subject code: 161601
### Subject Name: Modeling, Simulation & Operations Research

**Date:21/05/2011**                               **Time: 10.30 am – 01.00 pm**
                                                   **Total Marks: 70**

### Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** State any two definitions of Operation Research. Also explain the phases of Operation Research Study. **07**

**(b)** (1) What is the function of slack, surplus and artificial variables in simplex procedure of LPP? **04**

(2) Write the difference between a feasible solution, a basic feasible solution and an optimal solution of linear programming problem? **03**

**Q.2** **(a)** What steps are required in solving linear programming problems by graphical method? **07**

Formulate the LP model for the following problem using graphical method to determine as to how many units of each of the products should be produced per week so that the firm can earn the maximum profit.

A firm has engaged in producing two products, $P_1$ and $P_2$. Each unit of product $P_1$ requires 4kg of raw material and 6 labour hours for processing, whereas each unit of product $P_2$ requires 3 kg of raw material and 3 hours of labour, of the same type. Every week, the firm has an availability of 90 kg of raw material and 96 labour hours. One unit of product $P_1$ gives Rs 60 and one unit of product $P_2$ gives Rs 45 as profit.

**(b)** Solve the following linear programming problem using Simplex method and find an optimal solution. **07**
Maximize z = 7x + 14y
subject to:
$$3x + 2y \le 36$$
$$x + 4y \le 10 \text{ and } x \ge 0 , y \ge 0$$

**OR**

**(b)** "Every linear programming problem has a mirror image in the form of another linear programming problem, called its dual." Do you agree? Explain the primal-dual relationship in brief. Also support your answer with proper example. **07**

**Q.3** **(a)** (1) Discuss Two phase method with example in brief. **03**
(2) Explain shortest route problem with its applications. **04**

**(b)** Explain least cost method(LCM) to obtain initial feasible solution for the transportation problem. Give the initial feasible solution and total cost for the following transportation problem using the same method. **07**

A company owns facilities at six places. It has manufacturing plants at places A, B and C with daily production of 50, 40 and 60 units respectively. It has warehouses at three different places P, Q and R with daily demands of 20, 95 and 35 units respectively. Per unit shipping costs are given in the following table.

|  |  | Warehouse | | |
|---|---|---|---|---|
|  |  | P | Q | R |
| Plant | A | 6 | 4 | 1 |
|  | B | 3 | 8 | 7 |
|  | C | 4 | 4 | 2 |

**OR**

**Q.3** **(a)** Discuss assignment problem in brief. Enlist the various methods for solving the assignment problem and explain any one in detail. **07**

**(b)** A project with the following six activities is listed with the normal time period for completion of each activity. Draw the network diagram and find out the critical path. Also prove that an activity C is critical activity using early and late start and finish timings. **07**

| Activity | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Immediate Predecessor | --- | A | A | B | C | D,E |
| Time Duration | 4 | 8 | 8 | 5 | 7 | 5 |

**Q.4** **(a)** (1) What is dummy activity? Why do we need dummy activities in PERT network? Explain the same in brief and support your answer with neat sketches. **04**

(2) Give the difference between PERT and CPM. **03**

**(b)** Explain the types of queuing system with usage of six character code. **07**

**OR**

**Q.4** **(a)** (1) Explain operating characteristics of queuing system. **03**

(2) Write short note on: - Exponential Distribution and - Birth and Death Process **04**

**(b)** Discuss the term 'simulation' and 'modeling'. Explain the advantages and disadvantages of simulation. **07**

**Q.5** **(a)** What is meant by pseudo-random numbers? Explain any method for random number generation in detail. **07**

**(b)** (1) Explain benefits of better resource allocation. **03**

(2) Explain (i) first-come-first-served and (ii) priority-service in concerned with queuing structure. **04**

**OR**

**Q.5** **(a)** Explain the replacement problem or strategy. Describe some important replacement situations and policies? **07**

**(b)** Discuss various Queuing models. Also state the scope and applicability of queuing theory. **07**

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