GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-VII(NEW) • EXAMINATION – WINTER 2016

Subject Code:2171901 Subject Name: Operation Research Time:10.30 AM to 1.00 PM Instructions:

Total Marks: 70

Date:23/11/2016

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) What is linear programming problem? Discuss the scope and role of LPP in 07 solving management problems.
 - **(b)** A 24 hour supermarket has the following minimal requirements for cashiers: 07 Period 1 2 3 4 5 6 3-7 11-15 15-19 19-23 Time of the day (24 hour clock) 7-11 23-3 Minimum number required 7 20 14 20 10 5

Period 1 follows immediately after period 6. A cashier works eight consecutive hours, starting at the beginning of one of the six time periods. Determine a daily employee worksheet which satisfies the requirements with the least number of personnel. Formulate the problem as an LPP.

- Q.2 (a) Maximize Z = 10 x1 + 15 x2Subject to constraints, $2x1 + x2 \le 26$, $2x1 + 4x2 \le 56$, $x1 - x2 \ge -5$, $x1, x2 \ge 0$
 - (b) Maximize Z = 40 x1 + 35 x2Subject to constraints, $2x1 + 3x2 \le 60$, $4x1 + 3x2 \le 96$, $x1, x2 \ge 0$
 - (b) Obtain the dual of the LPP given here: Maximize Z = 8 x1 + 10 x2 + 5 x3Subject to constraints, $x1 - x3 \le 4$, $2x1 + 4x2 \le 12$, $x1 + x2 + x3 \ge 0$, 3x1 + 2x2 - x3 = 8, $x1, x2, x3 \ge 0$
- Q.3 (a) As new automobile vehicle costs Rs. 10000 and it can be sold at the end of any year with the selling price as shown. The operating and maintenance cost are given year wise in following table. Find when the automobile vehicle needs to be replaced because of wear and tear.

OR

| Year | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------------------|------|------|------|------|------|------|
| Selling price (Rs) | 7000 | 5000 | 3000 | 2000 | 1000 | 500 |
| Operating & Maintenance cost | 1000 | 1600 | 1800 | 2500 | 3000 | 3500 |
| (Rs) | | | | | | |

07

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Following are the records of demand of an item for the past one month. **(b)** 110

| · · |
|-----|
|-----|

| robability | 0.05 | 0.25 | |
|------------|---------------|-------------|--|
| 1. Calcu | late the expe | cted demand | |

100

Demand

Probability

2. The item cost price of an item is Rs. 25 and selling price is Rs. 30. If at the end of the day any surplus has to be disposed of at Rs. 20 per item. What is optimum output?

120

0.40

130

0.26

140

0.04

OR

- What is an assignment problem? Why it is called as a special case of the 07 0.3 **(a)** transportation problem?
 - (b) The captain of a cricket team has to allot five middle order batting positions 07 to 5 batsmen available for selection. The average runs scored by each batsmen at these positions are summarized in a table below.

| Dotomon | Batting positions | | | | | | |
|---------|-------------------|----|-----|----|----|--|--|
| Datsman | Ι | Π | III | IV | V | | |
| А | 40 | 46 | 48 | 36 | 48 | | |
| В | 48 | 32 | 36 | 29 | 44 | | |
| С | 49 | 35 | 41 | 38 | 45 | | |
| D | 30 | 46 | 49 | 44 | 44 | | |
| E | 37 | 41 | 48 | 43 | 47 | | |

Using Assignment model, determine the assignment of batsmen to positions which would give maximum runs in favor of team.

The details of activity and duration are shown below: 0.4 (a)

| Activity | А | В | С | D | E | F | G |
|-------------|----|---|---|---|-----|-----|-----|
| Depends on | - | А | А | А | B,C | C,D | E,F |
| Time, Days | 10 | 5 | 4 | 7 | 6 | 4 | 7 |
| D' 1 | | | | | | | |

Find:

- 1. Draw a network diagram
- 2. Find the critical path
- 3. Project duration
- Solve the following pay-off matrix for player A. Also find out the optimal **(b)** 07 strategy and value of the game using arithmetic method.

| | | Player B | | | | | |
|--------|----|------------|----|----|--|--|--|
| | | B 1 | B2 | B3 | | | |
| Player | A1 | 1 | 3 | 11 | | | |
| А | A2 | 8 | 5 | 2 | | | |

OR

- (a) What is degeneracy? How does the problem of degeneracy arise in a **0.4** 07 transportation problem? How can we deal with this problem?
 - (b) Company has factories A1, A2 & A3 which supply to warehouses at W1, W2 07 & W3. Weekly factory capacities are 240, 200 & 130 units respectively. Weekly warehouses requirements are 190, 150 & 110 units respectively. Unit transportation costs in Rs. is given in the table. Find initial basic feasible solution using VAM method & Optimum solution by MODI method.

| solution using (Thit method & optimum solution of mobili method. | | | | | | | |
|--|-----|-----|-----|--------|--|--|--|
| Company\Warehouse | W1 | W2 | W3 | Supply | | | |
| A1 | 16 | 20 | 12 | 240 | | | |
| A2 | 14 | 8 | 18 | 200 | | | |
| A3 | 26 | 24 | 16 | 130 | | | |
| Demand | 190 | 150 | 110 | 450 | | | |
| | | | | | | | |

07

- Q.5 (a) The annual demand of a product is 10,000 units. Each unit costs Rs. 40 if the orders are placed in quantities below 140 units. The order of 180 or above, the unit price is Rs. 40. Assume inventory holding cost as 10 % of the value of the item and the ordering cost is Rs. 2 per order. Find the economic lot size.
 - (b) Write a short note on ABC analysis.

07

OR

- Q.5 (a) Explain Kendall's notation for queuing system. Also explain the terms: 07 balking and jockeying.
 - (b) At barber's shop, the customers arrive at the average interval of 6 minutes
 07 and the barber takes on an average 5 minutes for serving the person.
 Calculate:
 - i. Counter utilization level
 - ii. Average no. of customers in service
 - iii. Average no. of customers in queue
 - iv. Average waiting time of the customers in the system
 - v. Expected average waiting time in the queue
 - vi. Probability that the barber is idle
 - vii. Probability of finding more than 3 customers in the system
