

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-VII • EXAMINATION – SUMMER • 2014**

**Subject Code: 172004****Date: 29-05-2014****Subject Name: Production Optimization Techniques****Time: 02.30 pm - 05.00 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)** Solve the following LP problem**10**

$$\text{Maximize } Z = 20x_1 + 30x_2$$

Subject to the constraints :

$$6x_1 + 3x_2 \leq 18$$

$$3x_1 + x_2 \leq 8$$

$$4x_1 + 5x_2 \leq 30$$

$$x_1, x_2 \geq 0$$

Write your comments.

**(b)** Explain the unboundedness and infeasibility of solution in LP problem.**04****Q:2 (a)** 1. What are different types of inventories? Explain.**03**

2. What function does inventory perform? State the two basic inventory decisions management must make as they attempt to accomplish the functions of inventory just described by you.

**04****(b)** A daily demand for bread loaves in the city can assume one of the following values : 3400, 3600, 3800 or 4000 with probabilities 0.18, 0.12, 0.20 or 0.50, respectively. If the stockist stocks more than the requirements, he has salvage value of Rs. 17 per bread loaf. Assume that a bread loaf costs him Rs. 18, which he can sell at Rs. 20, find the optimum stock level using the decision tree. There is no opportunity loss cost.**07****OR****(b)** How will you deal with replacement of items that fail completely and suddenly?**07**

- Q:3** The total normal cost for project is Rs. 5000, the cost of the supervision is Rs.300 per day, and the penalty for delay is Rs. 100 per day, for every day delayed beyond 16 days. Crash the duration of the project and find the following: **14**
- The duration of project with optimal cost.
  - The minimum possible duration for the project and the associated cost.

The predecessor relationships and other requirements are as follows:

| Activity | Predecessor | Normal Time (days) | Crash Time (days) | Incremental crashing cost (Rs./day) |
|----------|-------------|--------------------|-------------------|-------------------------------------|
| A        | -           | 3                  | 1                 | 600                                 |
| B        | -           | 4                  | 3                 | 200                                 |
| C        | B           | 3                  | 2                 | 400                                 |
| D        | B           | 5                  | 4                 | 500                                 |
| E        | B           | 6                  | 3                 | 300                                 |
| F        | A,C         | 4                  | 3                 | 200                                 |
| G        | E           | 5                  | 4                 | 500                                 |
| H        | A,C         | 3                  | 2                 | 400                                 |
| I        | F,D         | 5                  | 4                 | 300                                 |
| J        | H,I,G       | 2                  | 2                 | -                                   |

**OR**

- Q:3** A cement company has three factories which manufacture cement which is then transported to four distribution centres. The quantity of monthly production of each factory, the demand of each distribution centre and the associated transportation cost per quintal are given as follows: **14**

| Factory | Distribution centres         |      |      |      |      |                                  |
|---------|------------------------------|------|------|------|------|----------------------------------|
|         |                              | W    | X    | Y    | Z    | Monthly Production (in quintals) |
|         | A                            | 10   | 8    | 5    | 4    | 7000                             |
|         | B                            | 7    | 9    | 15   | 8    | 8000                             |
|         | C                            | 6    | 10   | 14   | 8    | 10,000                           |
|         | Monthly Demand (in quintals) | 6000 | 6000 | 8000 | 5000 |                                  |

- Suggest the optimal transportation schedule.
- Is there any other transportation schedule which is equally attractive?
- If the company wants at least 5,000 quintals of cement is transported from factory C to distribution centre Y, will the transportation schedule be any different? If so, what will be the new optimal schedule and the effect on cost?

- Q:4 (a)** A firm has a machine whose purchase price is Rs. 20000. Its maintenance cost and resale price at the end of different years are given here: **07**

| Year             | 1     | 2     | 3     | 4     | 5    | 6    |
|------------------|-------|-------|-------|-------|------|------|
| Maintenance cost | 1500  | 1700  | 2000  | 2500  | 3500 | 5500 |
| Resale price     | 17000 | 15300 | 14000 | 12000 | 8000 | 3000 |

- (a) Obtain the economic life of the machine and the minimum average cost.
- (b) The firm has obtained a contract to supply goods produced by the machine, for a period of 5 years from now. After this time period, the firm does not intend to use the machine. If the firm has machine of this type that is one year old, what replacement policy should it adopt if it intends to replace the machine not more than once?
- (b)** The number of customers approaching the tailor appears to be Poisson distributed with mean of 6 customers per hour. The tailor attends the customers on first come first served basis and the customer wait if the needed be. The tailor can attend the customers at an average rate of 10 customers per hour with the service time exponentially distributed. **07**
- Find the probability of the number of arrivals (0 through 5) during a 15 minute interval and 30 minute interval.
  - The utilisation parameter.
  - The probability that the queuing system is idle.
  - The average time that the tailor is free on a 10 hour working day.
  - The probability associated with the number of customers (0 through 5) in the queuing system.
  - What is the expected number of customers in the tailor shop?

**OR**

- Q:4 (a)** A machine operator has to perform three operations, namely plane turning, step turning and taper turning on a number of different jobs. The time required to perform these operations in minutes for each operating for each job is given in the matrix given below. Find the optimal sequence, which minimizes the time required. **07**

| Job | Time for plane turning in minutes | Time for step turning in minutes | Time for taper turning in minutes |
|-----|-----------------------------------|----------------------------------|-----------------------------------|
| 1   | 3                                 | 8                                | 13                                |
| 2   | 12                                | 6                                | 14                                |
| 3   | 5                                 | 4                                | 9                                 |
| 4   | 2                                 | 6                                | 12                                |
| 5   | 9                                 | 3                                | 8                                 |
| 6   | 11                                | 1                                | 13                                |

- (b)** A company has four market segments open and four salesmen are to be assigned one to each segment to maximize the expected total sales. The salesmen differ in their ability and the segments also differ in their sales potential. The details regarding the expected sales in each segment by a typical salesman under most favourable condition are given below. **07**
- Segment A = Rs. 60,000, Segment B = Rs. 50,000, Segment C = Rs. 40,000 and Segment D = Rs. 30,000. It is estimated that working under same condition, the ability of salesmen in terms of proportional yearly sales would be as below:
- Salesman W = 7, Salesman X = 5, Salesman Y = 5 and Salesman Z = 4.
- Assign segments to salesmen for maximizing the total expected sales.

- Q:5 (a)**
1. Explain briefly the procedure adopted in assignment algorithm. **04**
  2. What do you mean by balancing an assignment problem? What steps you take to solve maximization case in assignment problem? Explain. **03**
- (b)** A manufacturing company processes 6 different jobs on two machines A and B in the order AB. Number of units of each job and its processing times in minutes on A and B are given below. Find the optimal sequence and total elapsed time and idle time for each machine. **07**

| Job | No. of units for each job | Machine A:<br>Time in minutes | Machine B:<br>Time in minutes |
|-----|---------------------------|-------------------------------|-------------------------------|
| 1   | 3                         | 5                             | 8                             |
| 2   | 4                         | 16                            | 7                             |
| 3   | 2                         | 6                             | 11                            |
| 4   | 5                         | 3                             | 5                             |
| 5   | 2                         | 9                             | 7.5                           |
| 6   | 3                         | 6                             | 14                            |

**OR**

- Q:5 (a)**
1. With the help of quantity-cost curve, explain the significance of EOQ. What are the limitations of using the formula for an EOQ? **04**
  2. Discuss the assumptions underlying the basic EOQ formula. Also state the economic order quantity model, discuss its sensitivity, and explain its major extensions. **03**
- (b)** How does the sequencing technique help the manager? Draw a flow chart to show the method of solution of sequencing problems. **07**

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