



INDIAN INSTITUTE OF MATERIALS MANAGEMENT
Post Graduate Diploma in Materials Management
Graduate Diploma in Materials Management
Paper No. 2

Dec 2016

QUANTITATIVE TECHNIQUES AND OPERATIONS RESEARCH

Date: 11.12.2016

Max .Marks: 100.

Time: 2.00 to 5.00 p.m.

Duration: 3 hours

Instructions:

1. The Question Paper is in two parts- Part A (compulsory) and Part B.
2. From Part A answer all the questions. Each question carries 1 mark, total 25 marks. **(Total Marks 25)**
3. From Part B answer any five questions out of 8 questions .Each question carries **15 marks, total 75 marks.**
4. Use of non-scientific calculator and/or mathematical tables is permitted.
5. Graph paper can be used wherever necessary.

PART A
(Compulsory)

(25 marks)

Q1. (A) State whether the following statements are true or false: (15 Marks)

- a). Statistics is a science of estimates and probability.
- b). Quality means inferiority or no fitness for purpose.
- c). Information is value-added data.
- d). A source of demand in transportation problem is called as the origin.
- e). Customers jockey when they leave the queue.
- f). In homogeneity products, efficiency and machines are assumed identical.
- g). SIRO is a priority service discipline.
- h). Scheduling determines an order for a number of jobs to be performed on parallel machines.
- i). Arrival time follows Poisson distribution.
- j). Uncertainty means incomplete alternatives.
- k). Times estimates for an activity follow Gamma distribution.
- l). Capital budgeting is the decision of long term investment.
- m). A node on a network represents an event.
- n). λ indicates the arrival rate in a waiting line.
- o). A Normal distribution applies to a variable taking discrete values.

Q1. (B) Define the following: (2 marks each) (10 Marks)

- a). Pure Strategy
- b). Total Float
- c). Markov Chain
- d). Dummy Activity
- e). EOQ

PART B
(answer any five)

(5 x15 = 75 marks)

Q.2. (A). (5 Marks)

A logging concern must allocate logging equipment between two sites in the manner that will maximize its daily net revenues. They have determined that the net revenue of a cord of wood is \$1.90 from site 1 and \$2.10 from site 2. At their disposal are two skidders, one forwarder, and one truck. Each kind of equipment can be used for 9 hours per day, and this time can be divided in any proportion between the two sites. The equipment needed to produce a cord of wood from each site varies as shown in the table below.

Equipment hours needed to produce a cord of wood.

| Site | Skidder | Forwarder | Truck |
|------|---------|-----------|-------|
| 1 | 0.30 | 0.30 | 0.17 |
| 2 | 0.40 | 0.15 | 0.17 |

Q.2. (B). (10 Marks)

Use graphical method to Max $Z = \$30X + \$20Y$ (objective function)
Subject to

- $2X + Y \leq 1,000$ (soldering time constraint)
- $X + Y \leq 800$ (assembling time constraint)
- $X \leq 350$ (demand constraint for printers)
- $X \geq 0$ (sign restriction)
- $Y \geq 0$ (sign restriction)

Q.3. Optimize the following transportation table using Vogel's method. (15 Marks)

| To | E | F | G | H | Source Supply |
|--------------------------|----|----|----|----|---------------|
| From | | | | | |
| A | 10 | 30 | 25 | 15 | 14 |
| B | 20 | 15 | 20 | 10 | 10 |
| C | 10 | 30 | 20 | 20 | 15 |
| D | 30 | 40 | 35 | 45 | 12 |
| Dummy (X) | 0 | 0 | 0 | 0 | 1 |
| Destination Requirements | 10 | 15 | 12 | 15 | 52 |

Q.4.

(15 Marks)

Four jobs (J1, J2, J3, and J4) need to be executed by four workers (W1, W2, W3, and W4), one job per worker. The matrix below shows the cost of assigning a certain worker to a certain job. Find the optimal assignment and the minimum cost.

| | J1 | J2 | J3 | J4 |
|----|----|----|----|----|
| W1 | 82 | 83 | 69 | 92 |
| W2 | 77 | 37 | 49 | 92 |
| W3 | 11 | 69 | 5 | 86 |
| W4 | 8 | 9 | 98 | 23 |

Q.5. For the following list of activities:

(A) Draw the Network.

(5 Marks)

(B) Find, earliest start time, latest finish time, project completion time and the critical path.

(10 Marks)

| | | | | | | | | | | |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Activity: | 1-2 | 1-3 | 2-3 | 2-5 | 3-4 | 3-6 | 4-5 | 4-6 | 5-6 | 6-7 |
| Duration: (Weeks) | 15 | 15 | 3 | 5 | 8 | 12 | 1 | 14 | 3 | 14 |

Q.6.(A). What is inventory?

(5 Marks)

(B). ABC Ltd. is engaged in sale of footballs. Its cost per order is Rs.400 and its carrying cost unit is Rs.10 per unit per annum. The company has a demand for 20,000 units per year. Calculate the order size, total orders required during a year, total carrying cost and total ordering cost for the year. **(10 Marks)**

Q.7. Trucks arrive at a bridge according to Poisson pattern. The time required to weight the truck is exponential. The mean arrival rate is 12 and average service rate is 18 trucks per day. Find probability of no trucks, utilization factor and probability that a truck waits. **(15 Marks)**

Q.8. Maximize`

(15 Marks)

$Z = 6X_1 + 4X_2$ using the Simplex Method

Subject to the constraints

$$2X_1 + 3X_2 \leq 120$$

$$2X_1 + X_2 < 60$$

And non-negativity constraints

$$X_1 \geq 0 \text{ and } X_2 \geq 0$$

Q.9. Find the value of the game having the following pay-off matrix.

(15 Marks)

| | | Player B | | |
|----------|----|----------|----|----|
| | | B1 | B2 | B3 |
| Player A | A1 | -4 | 0 | 4 |
| | A2 | 1 | 4 | 2 |
| | A3 | -1 | 5 | -3 |
