



INDIAN INSTITUTE OF MATERIALS MANAGEMENT
Post Graduate Diploma in Materials Management
PAPER – 18 C
OPERATIONS RESEARCH.

Dec 2014

DATE: 20.12.2014
TIME: 2.00 p.m to 5.00 p.m.

Max. Marks: 100
Duration: 03 Hrs.

Instructions:

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|--|----------------|
| 1. The question paper is in two parts. | |
| 2. Part A is compulsory. Each question carries one mark | Total 25 marks |
| 3. In part B answers 5 questions out of 8. Each question carries 15 marks. | Total 75 marks |

PART A

25 marks

Compulsory -Each question carries 1 mark

Q.1. Select the correct answer from the multiple choices. 5 marks

- i) While solving a Linear programming problem infeasibility is removed by
- | | |
|------------------------------|----------------------------|
| a) adding another constraint | b) adding another variable |
| c) removing a constraint | d) removing a variable |
- ii) In a linear programming we need to ensure that both the objective function and the constraints can be expressed as linear expressions of
- | | |
|-----------------------|-----------------------|
| a) objective function | b) decision variables |
| c) constraints | d) basic variables |
- iii) In PERT slack time is
- | | |
|------------------------|-------------|
| a) LFT- LST | b) EFT- EST |
| c) LFT – Activity time | d) LFT-EFT |
- iv) Monte Carlo simulation includes all of the following except
- | | |
|-----------------------------|-----------------------------|
| a) Data collection | b) Analysis |
| c) Random number assignment | d) Finding optimal solution |
- v) Customer moving from one queue to another, thinking to obtain faster service is called
- | | |
|-------------|--------------|
| a) Pegging | b) Jockeying |
| c) Reneging | d) Balking |

Q.2. Fill in the blanks. (Do not reproduce the statement)**10 marks**

- a) Duality is used to solve a LPP by _____ method in which the initial solution is infeasible.
- b) _____ occurs when no value of the variable is able to satisfy all constraints in LPP simultaneously.
- c) _____ activities will delay the entire project if they are delayed.
- d) Johnson rule is associated with _____ problem.
- e) The time lag between the identification of a requirement to meet the requirement is called _____
- f) The process where the outcome of a given experiment affects the outcome of the next experiment is called _____.
- g) The increase in cost per unit of time saved by crashing is called _____
- h) In simplex method a feasible solution requires that all artificial variables are _____ .
- i) The third step in an ABC analysis is to arrange the items in the _____ order of annual consumption value.
- j) Penalty method used in transportation problem is also known as _____

Q.3. State True or False**10 marks**

- a. An optimal solution must use up all the limited resources available.
- b. The number of constraints in any LPP usually equals the number of iterations required to solve the problem.
- c. PERT uses three time estimate and it deterministic.
- d. The first come first served is a service mechanism.
- e. The first step to Monte Carlo simulation is to set up random number tables.
- f. When there is infinite number of servers the queue length is zero.
- g. When there are multiple solutions to an assignment problem it is said to be unbalanced.
- h. Dominance rule is used in the solution of Markov chains.
- i. Maintenance facilities are classified into Breakdown maintenance and preventive maintenance.
- j. The total supply must equal total demand in transportation problem to solve it by transportation algorithm.

PART B

75 marks

(Attempt any 5 Questions, each question carry 15 marks)

Q.4. Use simplex method to find the maximum value of

$$Z = 30X_1 + 40X_2 + 35X_3$$

Subject to constraints

$$3X_1 + 4X_2 + 2X_3 \leq 90$$

$$2X_1 + X_2 + 2X_3 \leq 54$$

$$X_1 + 3X_2 + 2X_3 \leq 93$$

Where $X_1, X_2, X_3 \geq 0$

(15 marks)

Q. 5. A Company has 4 factories A, B, C, and D manufacturing same commodity, which are to be transported to meet the demands in 4 warehouses. The supplies and demands as well as the unit transportation cost in rupees are given below.

	1	2	3	4	supply
A	25	55	40	60	60
B	35	30	50	40	140
C	36	45	26	66	150
D	35	30	41	50	50
Demand	90	100	120	140	

- Determine the optimum solution to minimize the costs . (10 marks)
- Calculate the minimum transportation costs. (3 marks)
- Comment on the uniqueness of the solution. (2 marks)

Q.6. Following table gives activities and time taken by each of these activities.

Activity nodes	to	tm	tp
1-2	3	5	7
1-3	6	8	10
1-4	4	9	14
2-3	4	6	8
2-5	5	10	21
3-4	8	11	14
3-6	3	6	9
4-6	7	13	19
5-6	9	12	21

- Draw the network diagram (4 marks)
- Identify the critical path and its duration. (3 marks)
- Calculate variance for each of the activities. (3 marks)

- d) Calculate earliest start time, earliest finish time, latest start time, latest finish time and float for each of the activities. (5 marks)

Q.7. a) A T V repairman finds that the time spent on his job has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they come and if the arrival of sets is Poisson distributed with an average rate of 10 per 8-hour day.

- i) What is the expected idle time each day?
 ii) How many jobs are ahead of the set just brought in?

(10 marks)

Q.7. b) Enumerate the attitudes of customer in a queuing system?

(5 marks)

Q.8. A company is engaged in manufacturing 5 brands of packed snacks. It is having five manufacturing setups, each capable of manufacturing any of its brands one at a time. The cost to make on these set ups vary as given below.

Typists	S1	S2	S3	S4	S5
B1	4	6	7	5	11
B2	7	3	6	9	5
B3	8	5	4	6	9
B4	9	12	7	11	10
B5	7	5	9	8	11

Assume the five setups are S1, S2, S3, S4, and S5 and five brands are B1, B2, B3, B4, and B5. Find the optimum assignment of products on these setups resulting in the minimum cost.

(15 marks)

Q.9. A bakery keeps stock of a popular brand of cakes. Previous experience shows the daily demand pattern for the item with associated probabilities, as given:

Daily demand (nos.)	Probability
0	0.01
10	0.20
20	0.15
30	0.50
40	0.12
50	0.02

Use the following sequence of random numbers to simulate the demand for next 10 days. Also find out the average demand per day.

Random Numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49
(15 marks)

Q.10. Write short notes on any five.

- Replacement theory
 - Assumptions of linear programming problem
 - Steps in ABC analysis
 - Saddle point and Dominance rule
 - Markov chains
 - Methodology of operations research
- (5x3 marks)

Q. 11. a) What are the conditions for sequencing n jobs on three machines

(3 marks)

b) Processing time for 5 jobs on three machines is given below.

Job	Processing time in hours		
	Machine a	Machine B	Machine C
1	3	3	5
2	8	4	8
3	7	2	10
4	5	1	7
5	2	5	6

- i) Find out the sequence of doing the jobs
- ii) Calculate the minimum processing time.
- iii) Calculate the idle time on machines B and C

(12 marks)
