# INDIAN INSTITUTE OF MATERIALS MANAGEMENT 

 Post Graduate Diploma in Materials Management Graduate Diploma in Materials Management
## PAPER - 2 <br> QUANTITATIVE METHODS

Date: 09.6.2009
Max. Marks: 100
Time: 2.00pm To 5.00pm
Duration: 3 hours

## Instructions:

1]. The question paper is in two parts- Part A: Objective Type (Compulsory) and Part B : Theory problems.
2]. From part $A$, answer all questions. Each question carries 1 mark, total 25 marks.
3]. From part B, answer any 5 questions out of 8 questions. Each question carries 15 marks, total 75 marks.
4]. Use of calculator and/or mathematical table is permitted.
5]. Graph sheet can be used wherever necessary.

## PART A

Q1. (A) State whether the following statements are true or false:
(15 Marks)
a). Linear Programming consists of linear objective and decision variables.
b). A two variable LPP problem cannot be solved by Simplex method.
c). Any action that maximizes expected gain would also minimize expected loss.
d). An assignment problem involves allocation of resources to facilities.
e). In a non-degenerate transportation problem, number of allocations is < m+n-1
f). A good network will have a critical path.
g). Shortest time first is a transportation algorithm.
h). An action that maximizes expected gain would does not minimize expected loss.
i). In preventive maintenance, there are few breakdowns..
j). A service pattern indicates customers' behaviour.
k). In a LIFO queue a customer is served immediately.
I). A mixed strategy is always selecting a course of action with a probability of $<1$.
$m$ ). In a two-person zero sum game, loss of one player is equal to loss of other.
n). $\quad \mu$ indicates a service rate in a queue system.
o). A Normal distribution applies to a variable taking discrete values.

Q1. (B)Define the following:
(10 Marks)
a). Unrestricted Variable
b). Surplus Variable
c) Constraint
d). Feasible Area
e). Graphical Method

## PART B

Q.2. Use the graphical method to solve the following LP problem:
(15 Marks)
Maximize $\quad Z=50 X_{1}+18 X_{2}$
Subject to the constraints

$$
\begin{gathered}
2 X_{1}+X_{2}<=100 \\
X_{1}+X_{2}<=80 \\
X_{1}, X_{2} \text { all }>=0 .
\end{gathered}
$$

Q.3. The cost of transportation per unit from three sources and four destinations is given below:
(All terms are in hundreds)

| Source | Destination |  |  |  | Supply |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1 | 2 | 3 | 4 |  |
| 1 | 2 | 3 | 5 | 1 | 8 |
| 2 | 7 | 3 | 4 | 6 | 10 |
| 3 | 4 | 1 | 7 | 2 | 20 |
| Demand | 6 | 8 | 9 | 15 |  |

a) Compute the initial basic feasible solution using Vogel's Approximation Method.
(5 Marks)
b) Test the solution for optimality and find the optimal basic feasible solution and total transportation cost.
(10 Marks)
Q.4. Five jobs are to be assigned to five men. The assignment has restriction that job 4 cannot be performed by man 1 and job 3 cannot be performed by man 4. Find the optimal assignment and cost involved. ( 15 Marks)

| Job |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Men | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ | $\mathbf{4}$ | $\mathbf{5}$ |  |
| $\mathbf{1}$ | 3 | 8 | 9 | 15 | 10 |  |
| $\mathbf{2}$ | 4 | 10 | 7 | 16 | 14 |  |
| $\mathbf{3}$ | 9 | 13 | 11 | 19 | 10 |  |
| $\mathbf{4}$ | 8 | 13 | 12 | 20 | 13 |  |
| $\mathbf{5}$ | 1 | 7 | 5 | 11 | 9 |  |

Q.5. The information regarding a project is given in the following table:

| Activity | Duration in days |
| :---: | :---: |
| $0-1$ | 21 |
| $1-2$ | 5 |
| $1-3$ | 7 |
| $2-3$ | 2 |
| $3-4$ | 0 |
| $4-5$ | 5 |
| $3-5$ | 8 |
| $5-6$ | 2 |

Draw the network for the above project. Assess the critical duration.
(10+5 Marks)
Q6.A Discuss with a diagram the behavior of customer in a queuing system.
Marks: 5
Q6.B In a railway marshalling yard, goods trains arrive at a rate of 15 trains per day. Assuming that the inter-arrival time is exponential with an average of 18 minutes, calculate:

Marks: 10
i). Expected line length
ii). Probability that the line size exceeds 5.
Q.7. Use the graphical method to solve the following LP problem:
(15 Marks)
Maximize $\quad Z=15 X_{1}+10 X_{2}$
Subject to the constraints

$$
\begin{aligned}
& 4 X_{1}+6 X_{2}<=360 \\
& 3 X_{1}+0 X_{2}<=180 \\
& 0 X_{1}+5 X_{2}<=200 \\
& X_{1}, X_{2} \text { all }>=0 .
\end{aligned}
$$

Q8.A Explain the assignment problem.
Marks: 5
Q8.B Five men $A, B, C$ and $D$ are available to do five jobs $1,2,3,4$. The time that each man takes to do each job is given in the following matrix. Find the optimal assignment.

Marks: 10

| MEN |  | I | II | III | IV |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | A | 9 | 5 | 6 | 5 |
|  | B | 7 | 8 | 8 | 2 |
|  | C | 7 | 7 | 9 | 4 |
|  | D | 7 | 5 | 7 | 7 |

Q9.A When a game can be strictly determinable?
Marks: 5
Q9.B
Marks: 10
For the game with payoff matrix:

| Player A | Player B |  |  |
| :---: | :---: | :---: | :---: |
|  | B1 | B2 | B3 |
| A2 | 2 | 5 | 1 |

Compute the value of the game.

