INDIAN INSTITUTE OF MATERIALS MANAGEMENT

Post Graduate Diploma in Materials Management
Graduate Diploma in Materials Management

Paper No.2
QUANTITATIVE METHODS

Date: 11.12 2011 **Max.Marks: 100.**

Time: 2.00 pm to 5.00 pm **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 calculator and/or mathematical tables is permitted.

5. Graph paper can be used wherever necessary.

<u>PART A</u>

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

a).   An infeasible solution to an LPP will have an artificial variable in final Simplex Table.

b).   Vogel's method is used for solving an assignment problem.

c).   If arrival rate is less than the service rate a queue is likely to be formed.

d).   If a decision variable has zero evaluation in final Simplex Table there is an alternate optimal solution.

e).   In an integer programming variables shall have integer values.

f).   A dummy loop will always be part of a network.

g).   A game theory problem can be solved as a linear programming problem.

h).   Principle of dominance reduces an m X n game to a 2 X 2 game.

i).   Average project duration of a network activity follows a beta distribution.

j).   Kendall's notation can be used to represent a queuing system.

k).   Inter-arrival time for a queue model is hyper geometric.

l).   Stock-outs do not depend on safety stock.

m).   Goal programming generates non-integer solutions to an LPP.

n).   SIRO is a type of customer in a queue.

o).   A Binomial distribution applies to a variable taking continuous values.

Q1. (B) Define the following: **(10 Marks)**

a).   LPP

b).   Graphical Method

c)   Source

d).   Safety Stock

e).   Beta distribution

PART B

Q.2. (A).   A garment manufacturer has a production line making two styles of shirts. Style I needs 200 g of cotton thread, 300 g of Dacron thread and 300 g of linen thread. Corresponding requirements of style II are 200g, 200g and 100g. The net contributions are Rs. 19.50 for style I and Rs. 15.90 for style II. The available inventory of cotton thread, Dacron thread and linen thread are, respectively, 24 kg, 26 kg and 22 kg. The manufacturer wants to determine the number of each style to be produced with the given inventory. Formulate the LPP model.

                                                                    (5 Marks)

Q.2. (B).   Solve the following LPP by graphical method

A firm produces chemical based products. In a particular process three raw materials are used to produce two products. The Material requirements per ton are:

Product	Material 1	Material 2	Material 3
Fuel additive	2/5	0	3/5
Solvent base	1/2	1/5	3/10

For the current production period the firm has available the following quantities of each raw material. Because of spoilage, any materials not used for current production must be discarded.

                            Number of Tons

                                Material Available for Production

Material 1   20

Material 2   5

Material 3   21

If the contribution to the profit is $40 for each ton of fuel additive and $30 for each ton of solvent base, how many tons of each product should be produced in order to maximize the total contribution profit? **(10 Marks)**

Q.3. A company has two plants producing a certain product that is to be shipped to three distribution centers. The unit production costs are the same at the two plants, and the shipping cost per unit is shown below:

Plant	Distribution Center		
	1	2	3
A	4	6	4
B	6	5	2

Shipments are made once per week. During each week, each plant produces at most 60 units and each distribution center needs at least 40 units. How many units should be shipped from each distribution center to each distribution center, so as to minimize cost? **(15 Marks)**

Q.4. A company has three jobs to finish and three machines for the jobs. Each job can be accomplished by any one of the three machines. But once a job is assigned to a machine, it should be finished with that machine. The cost of accomplishing a job with a machine is given in the table. How should we assignment jobs to machines so that the total cost is minimized?

(15 marks)

Machine->	1	2	3
Job 1	27	31	60
Job 2	49	38	37
Job 3	34	27	35

Q.5. From the table of activities associated with the project given below:
   i)   Draw the network
   ii) Find the critical path
   iii) Find the critical project duration.

Activities	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Duration in weeks	15	15	3	5	8	12	1	14	3	14

(15 Marks)

Q.6.(A).   Explain with example Job Sequencing.   **(5 Marks)**

Q.6.(B).   The information regarding jobs to be scheduled on one machine is as follows:

Job	A	B	C	D	E	F	G
Processing Time in days	4	12	2	11	10	3	6
Due date in days	20	30	15	16	18	5	9

Determine the shortest process time schedule.   **(10 Marks)**

Q.7.   **(15 Marks)**

On average 20 customers are served by a cashier in a bank. What is the probability that a customer will have to wait more than 10 minutes at the bank and the customer shall be free within 4 minutes at the bank?

Q.8.   **(15 Marks)**

Solve the LPP using Simplex Method:

Minimize $Z = X_1 - 3X_2 + 3X_3$

Subject to the constraints:

$3X_1 - X_2 + 2X_3 \leq 7$

$2X_1 + 4X_2 \geq 12$

$-4X_1 + 3X_2 + 8X_3 \leq 10$

$X_1, X_2, X_3 \geq 0$

Q.9.   **(15 Marks)**

Solve the following game by property of dominance.

Player B

		B1	B2	B3
Player A	A1	1	7	2
	A2	6	2	7
	A3	6	1	6