INDIAN INSTITUTE OF MATERIALS MANAGEMENT

Post Graduate Diploma in Materials Management
Graduate Diploma in Materials Management

Dec 2012

Paper No. 2

QUANTITATIVE METHODS

Date: 09.12.2012 **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

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

a) A degenerate solution to an LPP will have a tie on the choice of entering variable.

b) Optimal routine of school buses to different locations can be solved as a travelling salesman problem.

c) Erlang model is symbolically represented as (M/M/1) : (FCFS/∞/∞).

d) If a gain of one player equals the loss of other, the game is non-zero sum game.

e) Cutting plane algorithm can be used to solve assignment problem.

f) A basic infeasible optimal solution to an LPP can be obtained by Dual-Simplex.

g) A situation in which every source or destination is a potential source or destination can be modelled as transhipment problem.

h) Hungarian method fails to solve a maximization type assignment problem.

i) Total variance in a project is the total variance of the critical path.

j). Replacement theory can be used to understand mortality problems.

k). Inter arrival time in a waiting situation follows Poisson distribution.

l). Simulation is representation of reality through the use of a model.

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

n). Jockeying customers affect the queue size.

o). A normal distribution applies to a variable taking discrete values.

Q1. (B) Discuss the following: (10 Marks)

a). Pure Birth Process

b). MODI Method

c) Product Mix Problem

d). Equipment Replacement Policy

e). Beta distribution

PART B

Q.2. (A).

A carpenter makes tables and chairs. Each table can be sold for a profit of 30 and each chair for a profit of 10. The carpenter can afford to spend up to 40 hours per week working and takes 6 hours to make a table and 3 hours to make a chair. Customer demand requires that he makes at least 3 times as many chairs as tables. Tables take up 4 times as much storage space as chairs and there is room for at most 4 tables each week. Formulate this problem as a linear programming problem. **(5 Marks)**

Q.2. (B). Solve the following LPP by graphical method. **(10 Marks)**

Maximize $Z = f(x,y) = 3x + 2y$

subject to: $2x + y \leq 18$

$2x + 3y \leq 42$

$3x + y \leq 24$

$x \geq 0 , y \geq 0$

Q.3. For the following transportation cost table answer the questions given below: **(15 Marks)**

		MARKETS				
		A	B	C	D	Supply
WAREHOUSES	I	6	3	5	4	22
	II	5	9	2	7	15
	III	5	7	8	6	8
Requirement		7	12	17	9	

The shipping department has worked out the following schedule from experience: (I->B-12, I->C-1, I->D-9, II->C-15, III->A-7, III->C-1).

a. Find the optimal transportation cost and optimal schedule.

b. If the department is approached by a carrier of route III to B who offers to reduce the rate in the hope of getting some business, find the amount by which cost can be reduced to maintain the optimality.

c. If the supply from warehouse II reduces to 12 and simultaneously the requirements at market C reduces to 14, find the optimal transportation schedule.

Q.4. Four persons P1, P2, P3 and P4 have to do five jobs J1, J2, J3, J4 and J5. Each job is to be done by one person only. Each person does exactly one job except P2, who can do two jobs. Find an optimal assignment to minimize total cost.

(15 Marks)

	J1	J2	J3	J4	J5
P1	6	4	5	7	8
P2	7	5	8	6	9
P3	8	6	7	9	10
P4	5	7	8	4	6

Q.**5**.
1. Construct a PERT network for the project shown in the table below.
2. Find all the early and late event times and the event slack.
3. Determine the critical path and its length.

(15 Marks)

Activity	Immediately Preceding Activity	Expected Completion Time
a	-	2
b	-	3
c	-	2
d	b	4
e	a, b	3
f	b	2
g	f, c	5
h	g	4
i	f	3
j	i, d	2
k	j	1
l	e	6

Q.6.(A). Explain different costs in Inventory Management **(5 Marks)**

Q.6.(B). R & B Beverage Company has a soft drink product that has a constant annual demand rate of 3600 cases. A case of the soft drink costs R & B Rs.3/-. Ordering costs are Rs.20/- per order and holding costs is 25% of the value of the inventory. R & B has 250 working days per year, and the lead time is 5 days. Find economic order quantity and total annual cost.

(10 Marks)

Q.7.a. Explain basic structure of the queuing system. **(5 Marks)**

Q.7.b. Traffic to a message switching center for one of the outgoing communication lines arrive in a random pattern at an average rate of 240 messages per minute. The line has a transmission rate of 800 characters per second. The message length distribution (including control characters) is approximately exponential with an average length of 176 characters. Calculate the following principal statistical measures of system performance, assuming that a very large number of message buffers are provided: **(10 Marks)**

(a) Average number of messages in the system

(b) Average number of messages in the queue waiting to be transmitted.

(c) Average time a message spends in the system.

(d) Average time a message waits for transmission

(e) Probability that 10 or more messages are waiting to be transmitted.

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

Solve the LPP using Simplex Method:

Minimize $Z = X1 - 3X2 + 3X3$

Subject to the constraints:

$3 X 1 – X 2 +2 X 3 <= 7$

$2 X 1 + 4 X 2 >= 12$

$-4 X 1 + 3 X 2 + 8 X 3 <= 10$

$X1, X2, X3 >= 0$

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

Solve the following game by property of dominance.

Player B

		B1	B2	B3
Player A	A1	0	-2	7
	A2	2	5	6
	A3	3	-3	8

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