



INDIAN INSTITUTE OF MATERIALS MANAGEMENT

Post Graduate Diploma in Materials Management Graduate Diploma in Materials Management

June 2012

Paper No. 2

QUANTITATIVE METHODS

Date: 10.06.2012

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.
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PART A (Compulsory) (25 marks)

Q.1. (A) State whether the following statements are true or false.

- a) Mathematical Programming involves optimization of a function subject to certain constrains.
- b) In a linear programming problem every optimal solution is a feasible solution.
- c) Degeneracy in a LPP occurs when one or more of the basic variables assumes a value of zero.
- d) Degeneracy in a transportation problem occurs when a basic feasible solution has $m + n - 1$ positive basic variables.
- e) For a single- server, infinite population, queuing model the arrivals follow Poisson distribution.
- f) In Queuing theory, if ρ is the traffic intensity, then the probability that the system is idle is $1 - \rho$.
- g) In a network an event which represents the joint completion of more than one activities is called a burst event.
- h) At break-event point of sales there is neither profit nor loss.
- i) An ideal order size for inventory is where cost of stock holding is equal to the ordering cost.
- j) In a deterministic model of inventory control, the lead time is very high.
- k) The cost of inventory does not depend upon the cost of carrying the stock.
- l) A network will have only one critical path.
- m) Poisson distribution is a continuous probability distribution.
- n) In preventive maintenance, there are no breakdowns.
- o) In a two- person zero sum game, the loss of one player is equal to the gain of the other.

(B) Fill in the blanks**10 marks**

- (i) A linear programming is a technique for -----use of resources.
- (ii) Computation of internal rate of return is based on cash flows after-----.
- (iii) At break-even point there is -----profit or loss.
- (iv) A LPP with -----than three variables can be solved graphically.
- (v) A transportation problem is balanced if -----
- (vi) Inter-arrival times in a queue system follow-----distribution
- (vii) E O Q is the level when holding cost is -----to the ordering cost
- (viii) In a queue system F I F O means-----
- (ix) In a two-persons zero sum game the gain made by one is-----
- (x) Without time-value of money, a machine is replaced when average cost is

PART B (Answer 5 Out of 8 questions) (75 marks)**Q.2. Solve the following problem by simplex method:**

$$\text{Maximize } Z = 3 X_1 + 5 X_2$$

$$\text{Subject to: } X_1 + X_2 \leq 10, \quad 2 X_1 + X_2 \geq 12, \quad X_2 \leq 6$$

$$X_1 \geq 0, X_2 \geq 0$$

Q.3. A student has only five days before the examination to revise the four papers of his course. He decides to revise, at the most, one paper each day devoting one hour, two hours ...etc. The marks expected by him in the different papers for the given alternative arrangements are as shown in the matrix below:

Hours	Papers			
	I	II	III	IV
1.	30	20	15	20
2.	40	30	20	25
3.	45	40	35	40
4.	55	60	45	45
5.	70	80	90	65

How should he plan his revision so as to get maximum marks? Each paper is of 100 marks and pass percentage is 50 %. Should he hope to pass the examination, if plan is 95% successful ?

Q. 4 Find the optimal basic solution for the following transportation problem by MODI method.

	I	II	III	IV	Supply
1	5	3	8	4	250
2	4	8	6	9	450
3	10	5	4	2	500
Demand	200	400	300	300	

Q.5. The activities to be performed for the completion of a project are given below:

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	-	-	A	A	B	C,G	D,E	F	B	D,E,I
Duration	13	5	8	10	9	7	7	12	8	9

Draw a net –work and assess the critical duration .

- Q. 6** If λ is the average rate of arrival in Poisson distribution and μ is the average Service time in exponential distribution ($\lambda < \mu$), then: -
- Determine the average proportion of time T for which the service remains idle.
 - Show that if λ increases marginally by a unit then T decreases by time equal to μ .
 - If $\lambda = 12$ and $\mu = 15$, what should be the increase in the value of λ so that the Service remains busy all the time?
- Q.7 .a)** The initial cost of a machine is Rs. 3500. The maintenance cost and scrap value are given below (in Rupees). Time value of money is not to be considered. After how many years the machine should be replaced ?

Year	1	2	3	4	5
Maintenance cost	1800	2200	2700	3200	3700
Scrap value	1900	1050	600	500	500

b). Reduce the following game by dominance rule and solve to find its value:

Player B

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

Q 8 (a). Explain briefly break-even analysis.

(b). A book costs a publisher Rs. 150/- per copy to print it. His total fixed cost is Rs. 2500/- . He sells the book in the Market at the printed M.R.P of Rs. 200 per copy.

However he supplied a total of 50 books to the local libraries at a 10%. Discount on M.R.P. How many books in the market must be sold?

- i. to achieve break-even point
- ii. to make a minimum profit of Rs. 2000.

Q.9 (a). Explain briefly the advantages of the Replacement theory.

(b). A manufacturer requires units of an electronic component per year.

Various costs involved are given below:

Total demand per year: 2500 Units.

Component cost: Rs. 40. per unit

Ordering cost: Rs. 200. per order

Carrying cost: 10 % of cost per unit

- (i) Determine the economic order size.
- (ii) How often the order should be placed per year?
- (iii) What is the total annual variable inventory cost ?

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