June 2012

INDIAN INSTITUTE OF MATERIALS MANAGEMENT

Post Graduate Diploma in Materials Management

PAPER – 18 C

OPERATIONS RESEARCH.

DATE: 16.06.2012 **Max. Marks: 100**

TIME: 2.00 p.m to 5.00 p.m. **Duration: 03 Hrs.**

Instructions:

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 6. Each question carries 15 marks. Total 75 marks

---

PART – A (attempt all questions) (1x25 = 25 marks)

1. Select the correct option:
   a. If all the elements in the optimum column of a simplex table are negative, it is a case of
      i. Multiple optimal solutions.
      ii. Infeasible solution.
      iii. Unbounded solution.
      iv. None of the above.
   b. Basis Theorem is used when the number of variables is _______ the number of equations.
      i. Greater than
      ii. Less than
      iii. Equal to
      iv. Can't say
   c. _______ is a modified form of LPP specially used to reduce transportation cost.
      i. Transportation model
      ii. Assignment model
      iii. Queuing model
      iv. None of the above
   d. Which of the following is a method of finding the initial solution of a transportation model problem?
      i. North west corner rule
      ii. Stepping stone method
      iii. Both of the above
      iv. None of the above

e. Slack variables represent:
   i. Unused resource
   ii. Over-used resource
   iii. Redundant resource
   iv. Vital resource

2. Match the following:

Column "A"	Column "B"
a. Simplex method	i. Decision theory
b. Principle of dominance	ii. LPP
c. Graphical method	iii. George Dantzig
d. Least cost method	iv. Game theory
e. States of nature	v. Initial solution of transportation problem

3. Fill in the blanks:
   a. _______ method of finding the initial solution to a transportation problem often gives a solution which is the optimum solution.
   b. The objective function coefficient of an artificial variable is always equal to _______.
   c. An assignment problem is inherently _______.
   d. In an unbalanced transportation problem we have to add a dummy row or a _______.
   e. The dual of the dual is the _______ itself.

4. State true or false:
   a. OR is a tool employed to increase the effectiveness of managerial decisions as an objective supplement to the subjective feeling of the decision maker.
   b. The assignment model can be used for a maximization problem after calculating the opportunity costs.
   c. Artificial variables are introduced in an LPP to prevent a basic variable from assuming a positive value.
   d. The objective function coefficient of a slack variable is always equal to -1.
   e. A dummy activity is used for solving an assignment model problem.

5. Give the full forms:

a. LPP	b. CPM	c. VAM	d. MODI	e. EOQ

Part – B (answer any 5) 15 x5 = 75 marks

6. a. Define operations research. Discuss the origin and development of the discipline.

   b. A small manufacturer employs 5 skilled men and 10 semi-skilled men for making a product in two qualities – a deluxe model and an ordinary model. The production of the deluxe model requires 2 hours' work by a skilled man and 1 hour's work by a semi-skilled man. The ordinary model requires 1 hour's work by a skilled man and 3 hours' work by a semi-skilled man. According to the workers' union's rules, no man can work more than 8 hours per day. The profit from the deluxe model is Rs. 1000 per unit and from the ordinary model it is Rs. 800 per unit. Formulate a linear programming model for this manufacturing situation so as to maximize the total profit.

7. a. Explain how would you solve a minimization problem using simplex method.

   b. Solve using Simplex method:

   $$Maximise\ z = 8x_1 + 6x_2$$

   $subject\ to\ the\ constraints$:

   $$4x_1 + 2x_2 \leq 60$$

   $$2x_1 + 4x_2 \leq 48$$

   $$x_1 \geq 0, x_2 \geq 0$$

8. a. Describe the Vogel's Approximation Method.

   b. Find the minimum transportation cost for the following transportation problem:

Factory	**Warehouse**				**Capacity (Supply)**
	W1	**W2**	**W3**	**W4**	
F1	**21**	**16**	**25**	**13**	**11**
F2	**17**	**18**	**14**	**23**	**13**
F3	**32**	**27**	**18**	**41**	**19**
Requirement (Demand)	**6**	**10**	**12**	**15**	**43**

9. a. List the rules for formulating the dual.

b. Five different machines can do any of the five required jobs, with different profits resulting from each assignment as shown in the following table. Find out maximum profit possible through optimal assignment.

Job	Machine				
	A	B	C	D	E
1	30	37	40	28	40
2	40	24	27	21	36
3	40	32	33	30	35
4	25	38	40	36	36
5	29	62	41	34	39

10. a. Describe the steps involved in the Hungarian method for solving an assignment model problem.

b. Solve graphically:

Minimise $z=20x_1 + 40x_2$

subject to the constraints

$36x_1 + 6x_2 \geq 108$

$3x_1 + 12x_2 \geq 36$

$20x_1 + 10x_2 \geq 108$

$x_1, x_2 \geq 0$

11. a. Explain the maximin and minimax criteria of game theory.

b. Find the optimum sequence and minimum elapsed time:

	I	**II**	**III**	**IV**	**V**
M1	3	7	4	5	7
M2	6	2	7	3	4

12. a. Explain the differences between CPM and PERT.

b. Draw the following network diagram:

Activity	Predecessor	NT
A	-	9
B	A	4
C	A	2
D	-	4
E	G	1
F	B	5
G	C, D	10
H	B, I	3
I	E	6
J	H	7

Find critical path. Calculate minimum project duration.

13. a. Explain the Johnson's algorithm.

b. Customers arrive at a window drive in a bank according to Poisson distribution with mean 10 per hour. Service time per customer is exponential with mean 5 minutes. The space in front of the window, including that for the serviced car can accommodate a maximum of 3 cars. Other cars can wait outside this space.

i. What is the probability that an arriving customer car drives directly to the space in front of the window?

ii. What is the probability that an arriving customer car will have to wait outside the indicated space?

****