Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/MBA(New)/SEM-4 (PT)/MB-302/2011

2011

OPERATIONS RESEARCH

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

(Graph sheet(s) will be supplied by the Institution)

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) What is the method used to solve an LPP involving artificial variables ?

      a) VAM

      b) Charnes-Big M meghod

      c) Dominance method

      d) None of these.

   ii) Constraints in an LPP represent

      a) limitations

      b) requirements

      c) balancing limitations and requirements

      d) all of these.

iii) The optimality condition for minimumzation LPP in the simplex method is

a) $Z_j - C_j \geq 0, \forall_j$ b) $Z_j - C_j > 0, \forall_j$

c) $Z_j - C_j < 0, \forall_j$ d) $Z_j - C_j \leq 0, \forall_j$

iv) If an artificial variable is present in the 'basic variable' column of optimal simplex table, then the solution is

a) infeasible b) unbounded

c) degenerate d) none of these.

v) In an assignment problem, the minimum number of lines covering all zeros in the reduced cost matrix of order n can be

a) $n + 1$ b) $n - 1$

c) at least n d) at most n.

vi) If dual has an unbounded solution, primal has

a) unbounded solution b) feasible solution

c) no feasible solution d) none of these.

vii) In a mixed-integer programming problem

a) all of the decision variables require integer solution

b) few of the decision variables require integer solution

c) different objective functions are mixed together

d) none of these.

viii) Which of the following methods is used to verify the optimality of the current solution of the transportation problem ?

a) Least cost method

b) VAM

c) Modified distribution method

d) all of these.

ix) The expected value of perfect information is equal to

a) EPPI – Min (EMV)

b) EPPI + Max (EMV)

c) Max (EOL)

d) none of these.

x) Service mechanism in a queuing system is characterized by

a) server's behaviour

b) customer's behaviour

c) average number of customers

d) all of these.

xi) The elements of n-step transition matrix are obtained by using the formula

a) $P^n = P^{n-1} P^1$ b) $P^n = P^{n-2} P^2$

c) $P^n = P^{n-3} P^3$ d) none of these.

xii) Goal programming approach attempts to achieve each objective

a) sequentially b) simultaneously

c) both (a) and (b) d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Use the graphical method to solve the following L.P.P. :

Minimize $Z = -x + 2y$

subject to $-x + 3y \leq 10$

$x + y \leq 6$

$x - y \leq 2,\ x \geq 0, y \geq 0.$

3. Find the dual of the following primal :

Minimize $Z = 2x_1 + 3x_2 + 4x_3$

subject to $2x_1 + 3x_2 + 5x_3 \geq 2$

$3x_1 + x_2 + 7x_3 = 3$

$x_1 + 4x_2 + 6x_3 \leq 5$

$x_1, x_2 \geq 0$ and x_3 is unrestricted in sign.

4. Briefly discuss the Kendall notation of queuing model.

5. The following data is observed in a ticket serving counter. The arrival is for one minute interval :

No. of persons arriving :	0	1	2	3	4	5
Probability :	0·05	0·15	0·40	0·20	0·15	0·05

The service taken as 2 persons for one minute interval. Using the following random numbers, simulate for 15 minutes period : 09, 54, 94, 01, 80, 73, 20, 26, 90, 79, 25, 48, 99, 25, 89.

Also calculate the average number of persons waiting in the queue per minute.

6. If the arrival rate is λ and service rate is μ, then prove that the expected queue length is $\frac{\lambda^2}{\mu(\mu - \lambda)}$.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. Use Big-M method to solve the following L.P.P. :

Minimize $Z = 5x_1 + 3x_2$

subject to $2x_1 + 4x_2 \leq 12$

$2x_1 + 2x_2 = 10$

$5x_1 + 2x_2 \geq 10$

$x_1, x_2 \geq 0.$

8. Find the optimum solution of the following transporation problem by using VAM and also test the optimality by MODI method :

Destination

		A	*B*	*C*	Supply
Sources	*X*	4	8	8	76
	Y	16	24	16	82
	Z	8	16	24	77
Requirement		72	102	41	

9. Consider a certain community in a well defined area with three types of grocery stores ; for simplicity we shall call them I, II and III. Within this community (we assume that the population is fixed) there always exists a shift of customers from one grocery store to another. A study was made on January 1, 2011, it was found that $\frac{1}{4}$ shopped at store I, $\frac{1}{3}$ at store II and $\frac{5}{12}$ at store III. Each month store I retains 90% of its customers and losses 10% of them to store II. Store II retains 90% of its customers and losses 85% of them to store I and 10% of them to store III.

Store III retains 40% of its customers and losses 50% of them to store I and 10% of them to store II.

a) What proportion of customers will each store reatain by January 1, 2012 and January 1, 2013 ?

b) Assuming the same pattern continues, what will be the long run distribution of customers among the three stores ? 9 + 6

10. Mr. Sethi has Rs. 10,000 to invest in one of three options *A*, *B*, or *C*. The return on his investment depends on whether the economy experiences inflation, recession or no change at all. His possible returns under each economic condition are given below :

	State of nature		
Strategy	*Inflation*	*Recession*	*No change*
A	2,000	1,200	1,500
B	3,000	800	1,000
C	2,500	1,000	1,800

What should he decide using the pessimistic criterion, optimistic criterion, equally likely criterion and regret criterion ?

11. Solve the following integer programming problem using Gomory's cutting plane algorithm :

Maximize $Z = x_1 + x_2$

subject to $3x_1 + 2x_2 \leq 5$

$x_2 \leq 2$

$x_1, x_2 \geq 0$ and are integers.