Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/MBA/SEM-4 (PT)/MB-302/2012

2012
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 Institute on demand.

GROUP – A
(Multiple Choice Type Questions)

1.   Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

   i)   The solution of transportation problem with 'm' sources
         and 'n' destinations is non-degenerate, if the number of
         allocations are

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

         c) $m + n$ d) mn.

   ii)   Given a system of 'm' simultaneous linear equations in
         'n' unknowns ($m < n$). The number of basic variables
         will be

         a) m b) n

         c) $n - m$ d) $m + n$.

25018(MBA)   [Turn over

iii) Queuing theory deals with problems of

    a) materials handling

    b) reducing the waiting time or idle time

    c) better utilization of man services

    d) effective use of machines

    e) none of these

iv) In an assignment problem involving four workers and three jobs, total number of assignments possible is

    a) 4

    b) 3

    c) 7

    d) 12.

v) CPM has which of the following estimates ?

    a) One time estimate   b) Two time estimate

    c) Three time estimate   d) Four time estimate

    e) Nil time estimate.

vi) PERT has which of the following time estimates ?

    a) One time estimate

    b) Two time estimate

    c) Three time estimate

    d) Four time estimate

    e) Nil time estimate.

vii) In Markov analysis, the state probabilities must

    a) odd up to one

    b) be less than one

    c) be greater than one

    d) all of these.

viii) A type of decision making environment is

   a)   certainty   b)   uncertainty

   c)   risk   d)   all of these.

ix) VED analysis is applied for determining

   a)   slow moving items

   b)   high value items

   c)   critical items

   d)   none of these.

x) Job evaluation is the method of determining the

   a)   relative worth of jobs

   b)   skills required by a worker

   c)   contributions of a worker

   d)   contribution of a job.

xi) In Inventory control, the economic order quantity is the

   a)   optimum lot size

   b)   highest level of inventory

   c)   lot corresponding to break-even point

   d)   capability of a plant to produce.

xii) Which of the following is a valid objective function for a linear programming problem ?

   a)   Max $5\,xy$ b)   Min $4x + 3y + \left(\dfrac{2}{3}\right)z$

   c)   Max $5x^2 + 6y^2$ d)   Min $\dfrac{(x_1 + x_2)}{x_3}$.

xiii) Monte Carlo is a

    a)   Inventory technique   b)   Queuing technique

    c)   Marker process   d)   Simulation technique.

xiv) In a fair game the value of the game is

    a)   1   b)   0

    c)   unbounded   d)   none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2.   Find the dual of the following problem :

Minimize $Z = 2x_2 + 5x_3$
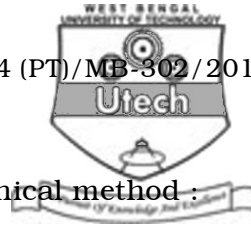
subject to the constraints

$x_1 + x_2 \geq 2$

$2x_1 + x_2 + 6x_3 \leq 6$

$x_1 - x_2 + 3x_3 = 4$

$x_1, x_2, x_3 \geq 0$

3.   Obtain an initial basic feasible solution to the following transportation problem :

Warehouse	Stores				Availability
	I	II	III	IV	
A	7	3	5	5	34
B	5	5	7	6	15
C	8	6	6	5	12
D	6	1	6	4	19
Demand	21	25	17	17	80

4. Solve the following problem using the graphical method :

   Minimize (total cost) $Z = 4x_1 + 3x_2$

   subject to the constraints

   $200x_1 + 100x_2 \geq 4000$

   $x_1 + 2x_2 \geq 50$

   $40x_1 + 40x_2 \geq 1400$

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

5. A firm makes two types of furniture-chairs and tables. The contribution for each product as calculated by the accounting department is Rs. 20 per chair and Rs. 30 per table. Both the products are processed on three machines M_1, M_2 and M_3. The time required (in hours) by each product and total time available per week on each machine are as follows :

Machine	Chair	Table	Available hours per week
M_1	3	3	36
M_2	5	2	50
M_3	2	6	60

   How should the manufacturer schedule his production in order to minimize contribution ? Formulate the problem as a linear programming problem.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

6. Using simplex method, determine the most profitable mix.

    Maximize, $Z = 10x_1 + 6x_2 + 4x_3$

    subject to the constraints

    $x_1 + x_2 + x_3 \le 100$

 $10x_1 + 4x_2 + 5x_3 \le 600$

    $2x_1 + 2x_2 + 6x_3 \le 300$

    $x_1, x_2, x_3 \ge 0$

7. A manufacturer wants to ship 8 loads of his product as shown in the table. The matrix gives the mileage from origin to destination. Shipping cost is Rs. 10 per load per mile. What shipping schedule should be used ?

	D_1	D_2	D_3	Supply
O_1	50	30	220	1
O_2	90	45	170	3
O_3	250	200	50	4
Demand	4	2	2	

8.a) A self service store employs one cashier at its counter. 8 customers arrive on an average every 5 min, while the cashier can serve 10 customers in the same time. Assuming Poisson's distribution for arrival and exponential distribution for service rate, determine —

      (i)   average number of customer in the system.
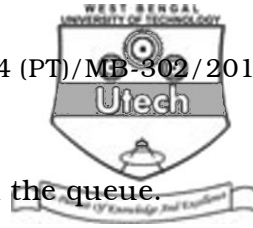
    (ii)   average number of customers in the queue.

    (iii)   average time a customer spends in the system.

    (iv)   average time a customer waits before being served.

b)   Two players A and B are playing a game where the possible outcomes due to their strategies are given in the following pay-off matrix. Explain the decision of the following game will be a mixed strategy :

Payoff matrix

	B_1	B_2	B_3
A_1	5	– 10	1
A_2	– 1	9	4

8 + 7

9.   A bakery keeps stock of popular brand of bread. Previous experience indicates the daily demand as given below :

Daily demand :	0	10	20	30	40	50
Probability :	0·01	0·20	0·15	0·50	0·12	0·02

Consider the following sequence of random numbers :

48, 78, 19, 51, 56, 77, 15, 14, 68, 9

Using above sequence, simulate the demand for the next 10 days :

    (i)   Faid out the stock situation if the owner of the bakery decides to make 30 breads every day.

    (ii)   Estimate the daily average demand for the bread on the basis of simulated data.
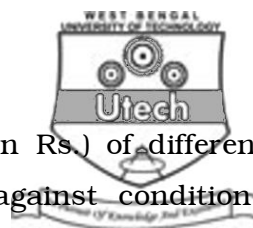
10. The following matrix gives the pay-off (in Rs) of different strategies (alternatives) S_1, S_2 and S_3 against conditions (event) N_1, N_2, N_3 and N_4.

State of Nature				
Strategy	N_1	N_2	N_3	N_4
S_1	4000	–100	6000	18000
S_2	20000	5000	400	0
S_3	20000	15000	– 2000	1000

Indicate he decision taken under the following approaches :

(i) Pessimistic

(ii) Optimistic

(iii) Equal probability.

the degree of optimism being 0·7.

11. An Airline company has drawn up a new flight schedule involving five flights. To assist in allocating five pilots to the flights, it has asked them to state their preference score by giving each flight a number out of 10. The higher the number, the greater is the preference. Certain of these flights are unsuitable to some pilots owing to domestic reasons.

These have been marked with as X

Flight Number

		1	2	3	4	5
	A	8	2	X	5	4
Pilots	B	10	9	2	8	4
	C	5	4	9	6	X
	D	3	6	2	8	7
	E	5	6	10	4	3

What should be the allocation of the pilots to flights in order to meet as many preferences as possible ?

═══════════