Seventh Semester B.E. Degree Examination, December 2012
Operation Research

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1 a. Define operation research. List the various phases of operation research.   **(05 Marks)**

   b. Discuss the areas of management where operation research techniques are applied.
                                                                       (05 Marks)

   c. The manager of an oil refinery has to decide upon the optimal mix of two possible blending process of which the inputs and outputs per production run are as follows:

Input			Output		
Process	Crude A	Crude B		Gasoline X	Gasoline Y
1	5	3		5	8
2	4	5		4	4

The maximum amounts available of crude A and B are 200 and 150 units respectively. Market requirement show that at least 100 units of gasoline X and 80 units of gasoline Y must be produced. The profit per production run from process 1 and process 2 are Rs.3 and RS.4 respectively. Formulate the problem as LP model.   **(10 Marks)**

2 a. Obtain the dual of the LP problem.
Minimize $Z = x_1 + x_2 + x_3$
Subject to $x_1 - 3x_2 + 4x_3 = 5$
$x_1 - 2x_2 \le 3$
$2x_2 - x_3 \ge 4$
$x_1, x_2 \ge 0$ and x_3 is unrestricted.   **(06 Marks)**

   b. Solve the LPP by using simplex method
Maximize $Z = 3x_1 + 5x_2 + 4x_3$
Subject to $2x_1 + 3x_2 \le 8$
$2x_2 + 5x_3 \le 10$
$3x_1 + 2x_2 + 4x_3 \le 15$
and $x_1, x_2, x_3 \ge 0.$ **(14 Marks)**

3 a. ABC limited has three production shops supplying a product to 5 ware hours. The cost of production varies from shop to shop, cost of transportation from shop to warehouse also varies. Each shop has a specific production capacity of each warehouse has certain amount of requirement. The cost of transportation are as given below:

Shop	Warehouse					Capacity	Cost for production
	I	II	III	IV	V		
A	6	4	4	7	5	100	14
B	5	6	7	4	8	125	16
C	3	4	6	3	4	175	15
Requirement	60	80	85	105	70		

Find the optimum quantity to be supplied from each shop to different warehouses at minimum total cost.   **(12 Marks)**

b. A truck company on a particular day has 5 truck for sending material to 6 terminals. The cost of sending material from same destination to different trucks will be different as given by the cost matrix below. Find the assignment of 4 trucks to 4 terminals out of 6 at the minimum cost. **(08 Marks)**

Trucks

	A	B	C	D	E
1	3	6	2	6	5
2	7	1	4	4	7
3	3	8	5	8	3
4	6	4	3	7	4
5	5	2	4	3	2
6	5	7	6	2	5

Terminals

4 a. List out the difference between transportation and assignment problem. **(05 Marks)**
   b. i) Define total elapsed time and idle time on a machine.
      ii) List the assumptions made while dealing with sequencing problem. **(05 Marks)**
   c. We have five jobs each of which must go through to machines A, B and C in the order ABC.

Job number	Processing time in hours				
	1	2	3	4	5
Machine A	5	7	6	9	5
Machine B	2	1	4	5	3
Machine C	3	7	5	6	7

Determine a sequence for the jobs that will minimize the total elapsed time and idle time for each machine. **(10 Marks)**

PART – B

5 a. What is queue discipline and list the various queue discipline? **(05 Marks)**
   b. At what average rate must a clerk at a supermarket work in order to ensure a probability of 0.9 that the customer will not have to wait longer than 12 minutes? It is assumed that there is only one counter to which customer arrive in a poisson fashion at an average rate of 15/hr. The length of service by the clerk has an exponential distribution. **(07 Marks)**
   c. In a hair dress by saloon with one barber, the customer arrival follows poisson distribution at an average rate of one every 45 minutes. The service time is exponentially distributed with a mean of 30 minutes. Find:
      i) Average number of customers in a saloon.
      ii) Average waiting time of a customer before service.
      iii) Average idle time of barber. **(08 Marks)**

6 a. Define:
      i) Critical activity and critical path.
      ii) Total float.
      iii) Free float. **(06 Marks)**

b. An R and D activity has 7 activities for which the three time estimates are given below along with its preceding activity.

Activity	Preceding activity	Optimistic time (a)	Most likely time (m)	Pessimistic time (b)
A	-	4	6	8
B	A	6	10	12
C	A	8	18	24
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

i) Draw PERT network.
ii) Find EST, LST and slack for each node.
iii) Find critical path and expected project duration. **(14 Marks)**

7 a. Define:
   i) Fair game and saddle point.
   ii) Pure strategy.
   iii) Mixed strategy. **(06 Marks)**

b. Following is the pay-off matrix for player A

$$\text{Player A} \begin{bmatrix} 2 & 4 & 3 & 8 & 4 \\ 5 & 6 & 3 & 7 & 8 \\ 6 & 7 & 9 & 8 & 7 \\ 4 & 2 & 8 & 4 & 3 \end{bmatrix}$$

Player B

Using dominance properties, obtain the optimum strategies for both the player and determine the value of the game. **(06 Marks)**

c. Solve the following game graphically with pay off matrix of A given in the table: **(08 Marks)**

Player B

	B_1	B_2
A_1	-2	0
A_2	3	-1
A_3	-3	2
A_4	5	-4

Player A

8 a. Explain zero-one integer programming. **(05 Marks)**

b. Solve the following linear programming by Gomory technique:

Maximize $Z = x_1 + x_2$
Subject to $2x_1 + x_2 \le 6$
             $4x_1 + 5x_2 \le 20$
             $x_1, x_2 \ge 0$ and integers. **(15 Marks)**

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