Registration No : | | | | | | | | | | |

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MCA
MCC405

4^{th} Semester Back Examination 2018-19
QUANTITATIVE TECHNIQUES - I (OPERATIONS RESEARCH)
BRANCH : MCA
Time : 3 Hours
Max Marks : 70
Q.CODE : F595
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) Why do we need artificial variable?
b) How the assignment problem can be viewed as a linear programming problem?
c) When does degeneracy occur in transportation problem?
d) Distinguish between a balanced and an unbalanced transportation problem.
e) Give some important applications of queuing theory?
f) Write the major decisions concerning inventory?
g) How does the Hungarian method indicate that the assignment problem has multiple optimal solution?
h) State pure birth process.
i) State three types of floats.
j) Distinguish between decision under certainty and decision under uncertainty.

Q2 **a)** Solve by big-M method the following linear programming problem : **(5)**
Minimize

$$Z = 2x_1 + x_2$$

Subject to the constraints:

$$3x_1 + x_2 = 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \leq 4$$
$$x_1,\ x_2 \geq 0$$

b) A company produces two articles X and Y. These are two departments through which the articles are processed assembly and finishing. The potential capacity of the assembly department is 48 hours a week and that of the finishing department is 60 hours a week. Production of each of X requires 2 hours of assembly and 4 hours of finishing. Each unit of Y requires 4 hours in assembly and 2 hours in finishing department. If profit is Rs.6 for each unit of X and Rs.7 for each unit of Y, find out the number of units of X and Y to be produced each week to obtain maximum profit. **(5)**

Q3 **a)** Explain Time-cost trade-offs with an example. **(5)**
b) A stockiest has to supply 400 units of a product every Monday to his customers. He gets the product at Rs.50 per unit from the manufacturer. The cost of ordering and transportation from the manufacturer is Rs.75 per order. The cost of carrying inventory is 7.5% per year of the cost of the product. Find (a) the economic lot size (b) the total optimal cost. **(5)**

Q4 a) Explain the role of duality theory in sesnsitivity analysis. **(5)**

b) A department has five employess with five jobs to be performed. The time (*in hours*) each men will take to perform each job is given in the following effectiveness matrix: **(5)**

		Employees				
		I	***II***	***III***	***IV***	***V***
	A	10	5	13	15	16
Jobs	***B***	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How should the jobs be allocated one per employee so as to minimize the total man hours. Use Hungarian method to solve this.

Q5 a) A small project consists of following activities : **(5)**

Activity	***Preceding Activity***	***Activity duration (Days)***
A	–	4
B	–	5
C	–	7
D	A	6
E	B	7
F	C	6
G	D	5
H	E	8
I	F	5

(i) Draw the Network and find critical path and the project completion time.
(ii) Calculate EST, EFT, LST LFT and the total float for each of the activities.

b) Three time estimates are given for each activity of the project: **(5)**

Activity	***Optimistic Time (weeks)***	***Most likely Time (Weeks)***	***Pessimistic Time (Weeks)***
1-2	6	6	24
1-3	6	12	18
1-4	12	12	30
2-5	6	6	6
3-5	12	30	48
4-6	12	30	42
5-6	18	30	54

i) Draw the project network.
ii) Find the critical path and the expected project completion time.
iii) What will be project completion time for 90% confidence of completion?
iv)

Q6 A supermarket has two girls ringing up sales at the counters. If the service time for each customer is exponential with mean 4 minutes, and if people arrive in a Poisson fashion at the counter at the rate of 10 per hour, then calculate: **(10)**

a) The probability of having to wait for service;
b) The expected percentage of idle time for each girl;
c) If a customer has to wait, find the expected length of his waiting time.

Q7 A company has three cement factories located at three cities X, Y and Z which supply cement to four project sites located in cities A, B, C and D. Each plant can supply 6, 1 and 10 truckloads of cement daily and the daiy requiremnts of the projects are 7, 5, 3 and 2 truckloads respectively. The transportation cost (*in thousand rupees*) per truckload of cement from each plant to each project site are given below: **(10)**

		Projects			
		A	***B***	***C***	***D***
	X	2	3	11	7
Plants	***Y***	1	0	6	1
	Z	5	8	15	9

Detrmine the optimal distribution of the company so as to minimize the total transportation cost. Use VAM method to find the initial IBCS.

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Transshipment Problem
b) Deterministic Multiechelon inventory models
c) Decision trees