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

M.Tech
P2INCC01

2nd Semester Regular Examination 2016-17
Decision Modelling– II
BRANCH:INDUSTRIAL ENGG, INDUSTRIAL ENGG & MANAGEMENT
Maximum Marks – 100
Time – 3 Hours
Q.CODE:Z357
Question number 1 which is compulsory. Answer any Four from the rest.
The figures in the right-hand margin indicate marks

1. **Answer the following questions:** (2x10)

a) Distinguish between linear and non-linear optimization problem.

b) Write the Hessian matrix of the function $f(x) = x_1^2 + x_2^2 - 2x_1 + x_1x_2 + 1$

c) Distinguish between local optima and global optima.

d) State the principle of optimality with respect to dynamic programming.

e) Write the notation system to classify queuing systems.

f) Distinguish between discrete and continuous distribution.

g) Compare Poisson distribution and Exponential distribution.

h) Explain the meaning of 'Steady State'.

i) What is pseudo-random number?

j) If 0.57, 0.42, 0.76, 0.19, 0.81and 0.33 are six uniform random number in the range from 0 to 1 generate corresponding uniform random number in the range minus 1 to plus 1.

2. a) Solve the following Quadratic Programming problem (10)

Maximize $z = x_1 + 2x_2 - x_2^2$

Subject to

$x_1 + 2x_2 \le 4 \qquad 3x_1 + 2x_2 \le 6 \qquad x_2 > x_1 \ge 0$

b) Solve the following problem using Kuhn Trucker condition (10)

Minimize $z = x^2 - y$

Subject to

$x + y = 6 \qquad x^2 + y^2 \le 26 \qquad x \ge 1 \qquad y \ge 0$

3. a) Solve the following problem using Dynamic Programming (10)

Minimize

$z = x_1^2 + x_2^2 + x_3^2$

Subject to

$x_1 + x_2 + x_3 \ge 12 \qquad \text{and} \qquad x_1, x_2, x_3 \ge 0$

b) The owner of chain of three grocery stores has purchased seven crates of mangoes. The estimated sale of mangoes before spoilage differs among three stores. Thus the expected profit from each store depends on number of crates allocated to it as given below. (10)

Number of crates	Expected profit from stores		
	Store 1	Store 2	Store 3
1	30	25	28
2	50	47	50
3	65	68	65

4	85	90	80
5	100	110	90
6	110	115	100
7	115	120	105

For administrative reasons, a crate cannot be split among stores. Determine how the crates should be allocated to each store for maximization of profit.

4. a) Illustrate the application queuing theory with example. (10)
   b) Average arrival rate of customers to a service centre is 18 per hour. It takes about 3 minutes to serve one customer. (10)
   i. What is the percentage of time the facilities of the service centre is not utilized?
   ii. Average length of queue
   iii. Average time duration a customer waits in the queue.
   iv. Probability that a customer does not have to wait for more than 10 minutes in the queue.

5. a) While planning transport system of a city, it is estimated that in a year about 10% of commuters who use public transport will switch to private transport. Similarly 20% of those who (have their own vehicle) use private transport are likely to switch to public transport. Presently, about 60% of people use private transport. What percentage of people will use public transport after two years? If this trend continues what percentage of people will use public transport in long run? (10)

   b) A system can operate in two different modes. Every hour, it remains in the same mode or switches to a different mode according to the transition probability matrix (10)

$$P = \begin{bmatrix} 0.4 & 0.6 \\ 0.6 & 0.4 \end{bmatrix}$$

   i. If the system is in Mode I at 5PM, what is the probability that it will be in Mode I at 9PM on the same day?
   ii. What is the probability that the system will be in mode-1 at steady state?

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6. a) Solve the following problem using Lagrange Multiplier. (10)

$$z = x^2 + y^2 - 8x + 4y + 10$$

   Subject to

   x + y = 4

   b) Sample data of inter-arrival time of jobs and service time of jobs at a service centre are given below. (10)
   Inter-arrival time of jobs: 5, 3, 2, 4, 3, 6, 4, 5, 4
   Service time of jobs: 4, 3, 3, 5, 4, 2, 5, 3, 4
   At the start of service station no jobs were in queue. Do hand simulation on above data to determine:
   i) Fraction of total time, when the service centre remains idle
   ii) Average time the job remains in service centre.

7. a) Explain the use of random numbers in simulation. (10)
   b) Illustrate the application of simulation with a suitable example. (10)