Second Semester Examination 2013
DECISION MODELLING - II
Time: 3 Hours
Max marks: 70

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

Q1. Answer in brief. (2 x 10)
   a) Explain what is meant by non-linear programming with unconstrained optimization. ✓
   b) Distinguish between local optima and global optima.
   c) Explain what is Transition Probability Matrix? ✓
   d) Distinguish between random number and pseudo-random number. ✓
   e) State the advantages of simulation. ✓
   f) Write the standard notation system to classify queuing systems. ✓
   g) Define a system and state of a system. ✓
   h) Explain the meaning of 'Steady State'. ✓
   i) If 0.52, 0.85, 0.70, 0.09 and 0.33 are five uniform random integers in the range from 0 to 1 generate corresponding uniform random integers in the range 500 to 900.
   j) Write the relationship between Poisson distribution and Exponential distribution

Q2. a) Write short notes on Bisection method for solving non-linear programming problem.
   b) Write the Kuhn-Tucker condition for following non-linear problem.
   Maximize $z = 15x_1 + 30x_2 + 4x_1 x_2 - 2x_1^2 - 4x_2^2$
   Subject to $x_1 + 2x_2 \leq 30$ $15, 7.5$
   $x_1, x_2 \geq 0$ (5 + 5)

Q3. Show that the following problem can be made separable. (10)
   $Maximize\ z = x_1 x_3 + 2x_2 + 2x_1 x_2$
   $Subject\ to\ \ x_1 x_3 + x_3 + 2x_1 x_2 \leq 20$
   $x_1, x_2, x_3 \geq 0$

Q4. a) Explain the application of Dynamic programming with the help of a suitable example. (5 + 5)
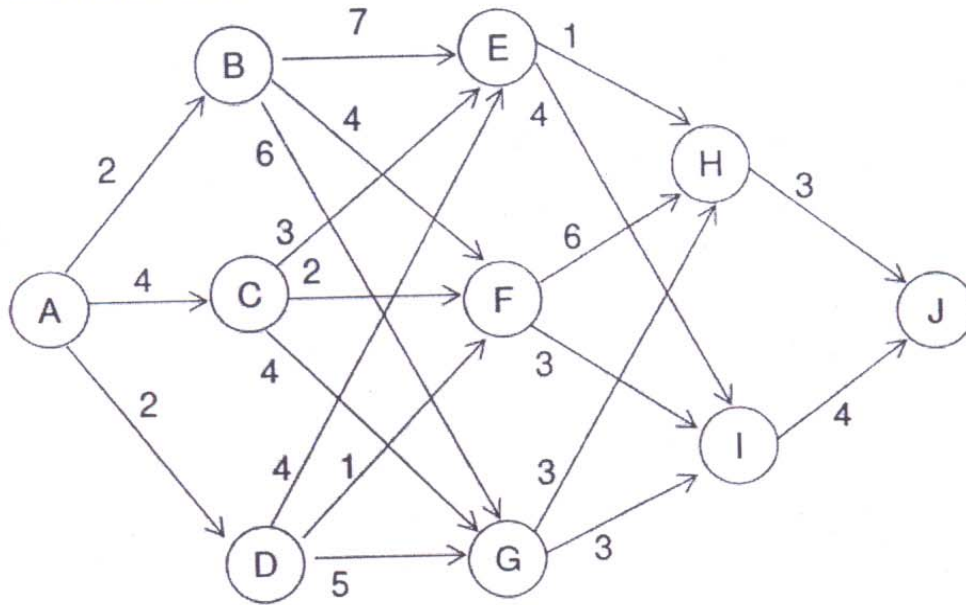   b) Solve by Dynamic programming.
   Maximize $Z = x_1 + x_2^2$
   Subject to:
   $2x_1 + x_2 \leq 30$
   $2x_1 - x_2 \geq 6$
   $x_1, x_2 \geq 0$

Q5. Find the shortest path from A to J by using Dynamic Programming. The numbers along the arrows show the distance between nodes. (10)

Q6. a) Explain the relationship between Poisson distribution and Exponential distribution.
b) The average arrival rate of customers to a petrol pump is 22 per hour. Average time to serve one customer is 2 minutes. Determine
  i.   Average time a customer waits in a queue to be served
  ii. Average length of queue
  iii. Average idle time of petrol pump

(5 + 5)

Q7. The survey of a certain region shows that in 5-year interval 6% of village population move to towns and 4% to cities. For the town population, 5% move to village areas and 10% to the cities. The city population would not move into towns, but 10% of them move to quiet village life. Present population of villages, towns and cities are 10 million, 6 million and 4 million respectively. Determine the population of villages, towns and cities after 15 years.
  i) If there is no increase or decrease in total population,
  ii) If rate of population growth is 1% per year

(10)

Q8.   a) Explain the use of random numbers in simulation. ✓
      b) The inter-arrival time of jobs to a service station and the time taken to complete these jobs are given below.
      Inter-arrival time of jobs: 6, 2, 5, 3, 2, 4, 3
      Service time of jobs: 4, 3, 3, 4, 5, 2, 5
At the start of service station no jobs were in queue. Based on above data, do hand simulation to determine:
      i) What fraction of time the service station remains idle?
      ii) What is the average time the job remains in service station?

(5 + 5)