Simulation
3-rd and 4-th Year Undergraduate
Mid-Term Examination
2009-12-7 time: 90 minutes (score: each 10)

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1-What kind of problems are with simulation?
2-What are the events in M/M/1 queue.
3 What is the Monte Carlo simulation.
4- In a Bank, what is state of the system?
5- Classify simulation models in to three different dimensions.
6- Name two approaches for the simulation clock advancing.
7- Write the differential equations for predator-prey problem.

8-Find the value of the following integral by using the Monte-Carlo method (use 6 points).

$$I = \int_{\pi/4}^{3\pi/4} \log_e(\sin x) dx$$

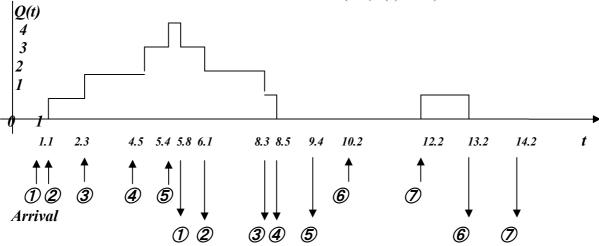
- a) Generate U(0,1) by computer or any means (if you cannot use the following RNG):  $U=0.012 \quad 0.238 \quad 0.123 \quad 0.880 \quad 0.813 \quad 0.763$
- b) Use the relation:  $X=(\Pi/2)U+\Pi/4$  to map from U(0,1) into  $X(\Pi/4, 3\Pi/4)$
- c) Then use  $g(x_i) = \log_e(\sin x_i)$  to find  $g(x_i)$  and fill the following table:

Using Monte-Carlo with 6 points: I=

- 9-In the following single server queuing MM1 system, find:
  - a) Average delay in queue.
  - b) Average number of customers in the queue.
  - c) Efficiency of utilization of the server.

    ( i means i th arrival and  $\downarrow$  i means i th departure)

    (n=7, T(n)=14.2)



**Departure**