Simulation **University of the Ryukyus**
3-rd and 4-th Year Undergraduate **Faculty of Engineering**
Mid-Term Examination **Department of Information Eng.**
2010-11-26 time: 90 minutes (score: each 10) **Prof. Mohammad Reza Asharif**

1-What is a system?

2-What is an iconic model?

3-In a single server, what are the "state variables"?

4- What are the "events" in a single server model?

5- What is the simulation clock?

6- Which models use random number? A) Deterministic B) Stochastic

7- Name two approaches for the simulation clock advancing.

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

$$I = \int_0^{2\pi} e^{(\sin x)} dx$$

a) Generate U(0,1)by computer or any means (if you cannot use the following RNG):
U=0.480 0.615 0.352 0.730 0.189 0.281

b) Use the relation: X=(2 Π)U to map from U(0,1) into X(0, 2 Π)

c) Then use $g(x_i)= e^{(\sin xi)}$ to find $g(x_i)$ and fill the following table:

Table 1

i	*1*	*2*	*3*	*4*	*5*	*6*
x_i						
$g(x_i)$						

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.