Simulation **University of the Ryukyus**
3-rd and 4-th Year Undergraduate **Faculty of Engineering**
Mid-Term Examination **Department of Information Eng.**
2011-12-2 time: 90 minutes (score: each 10) **Prof. Mohammad Reza Asharif**

1- What is a simulation?

2- What kind of problems are with simulation?

3- Classify simulation models into three different dimensions.

4- Name two approaches for the simulation clock advancing.

5- What is the Monte Carlo simulation?

6- What are the three measures of the system performance in a single server queuing system?

7- In which simulation model, a) time is considered? b) random numbers are used?

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

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

a) Generate U(0,1)by computer or any means (if you cannot use the following RNG):
U=0.711 0.520 0.144 0.929 0.291 0.468

b) Use the relation: X=(2 π)U to map from U(0,1) into X(0, 2 π), then find cos(xi).

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

Table 1

i	*1*	*2*	*3*	*4*	*5*	*6*
cos(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 (d(n): ADQ).
b) Average number of customers in the queue (q(n): ANCQ).
c) Efficiency of utilization of the server (u(n): %).