Simulation **University of the Ryukyus**
3-rd and 4-th Year Undergraduate **Faculty of Engineering**
Mid-Term Examination **Department of Information Eng.**
2008-12-15 time: 90 minutes (score: each 10) **Prof. Mohammad Reza Asharif**

1- What is system?

2- What is state of a system?

3- In which simulation models time is considered? A) Static, B) Dynamic.

4- In single server queue model, what are the "state variables"?

5- Name two approaches for the simulation clock advancing.

6- Write the differential equations for predator-prey problem.

7- What are the three measures of the system performance in a single server queueing system?

8-Find the value of the following integral by using the Monte-Carlo method and compare with the true value of the integral (use 6 and 11 points as shown in the table 1 and 2).

$$I = \int_1^2 x \log_e(x) dx = [\frac{1}{2} x^2 \log_e x - \frac{1}{4} x^2]_1^2$$

Table 1

i	*1*	*2*	*3*	*4*	*5*	*6*
x_i	1.0121	1.2383	1.1236	1.8808	1.8132	1.7633
$g(x_i)$	0.0122	0.2647	0.1310	1.1881	1.0791	1.0002

where: $g(x_i)=x \log_e(x_i)$

Using Integral: I=
Using Monte-Carlo with 6 points: I=
Using Monte-Carlo with 11 points: I=

Table 2

i	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***1 0***	***11***
x_i	1.1827	1.5097	1.6476	1.5096	1.5992	1.3364	1.7235	1.1181	1.5198	1.9952	1.3133
$g(x_i)$	0.1985	0.6218	0.8227	0.6217	0.7508	0.3876	0.9382	0.1248	0.6362	1.3781	0.3580

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.***

ci) (i means i th arrival *and* i means i th departure)