Simulation Exam. Name: **University of the Ryukyus**
3-rd year undergraduate No: **Faculty of Engineering**
2009-2-9 Last Term Examination **Department of Information Eng.**
Time: 90 minutes (write answers in boxes) **Prof. M.R. Asharif**

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1-In the mixed congruential generator:

$$x_{n+1} = 101x_n + 11(\mathrm{mod}100)$$

Simulate the first five numbers with seed $x_0 = 1$.Can you estimate a rule for x(8)? *(Hint: See page 58-61)* *10%*

x(0)=1,	x(1)=	,x(2)=	,x(3)=	,x(4)=	, x(5)=	x(8)=

***2*- In randomised response technique (RRT), if we have:**

Pr[Yes|N]=0.1 (answering probability to non-embarrassing question).
Pr[Yes| E]=0.9 (answering probability to embarrassing question).
p_0=0.2 (probability for answering to non-embarrassing question).
Find Pr[Yes]=*?* (total probability from survey).

(Hint: See page 51)

10%

Pr[Yes]=

***3*- In the following chaotic system:**

x(n+1)=4 r x(n) [1-x(n)]

If the attractor of this chaotic system will be x(∞)=0.6, find "r" by simulation or direct computation [for any value of x(0)]. *10%*

(*Hint: See chap*

r=

***4*- Find the probability of S=k, if we have the following relation:**

S=X+Y

Where both random variables X and Y have the Geometric distribution:

$Pr[X=i]= q^{i-1} p$ and $Pr[Y=i]= q^{i-1} p$ *(see page 16)*

(Hint: See page 38) *10%*

Pr[S=K]=

***5*- Simulate a Binomial random variable *X* with *B(7,0.75)* from a set of uniform random variables *U (0,1)*, by using Bernouli random variable, where:**
U1=0.6068, U2=0.4860, U3=0.8913, U4=0.7621, U5=0.4565, U6=0.0185,U7=0.8214

(Hint: See page 82)

10%

X=

0 ***p=0.75*** ***1***

***6-* Use the table-look-up method to simulate random variables *X* from *U(0,1)*. Where the p.d.f of *X* has logistic distribution** *(see page 28)* **as follows:**

$$f(x)=e^{-x}/(1+e^{-x})^{2}, \qquad -\infty<x<\infty$$

10%

Also, find the value of *X* when *U=0.5*

(Hint: see page 95-96)

X=
X|u=0.5 =

7-* Simulate the normal distributed random variables *(N1, N2)* by using Box-Muller method from the following pair of uniform distributed random variables: *(U1,U2)=(0.606,0.25) *(Hint: See page 78 use Eq. 4.1)*

10%

(N1,N2)=

***8-* Simulate the random variable X with the following probabilities:**

(Hint: see page 93-94)

10%

I	0	1	2	3	4	5	6
Pr [X<I]	0.2311	0.4860	0.6068	0.8913	0.9218	0.9568	0.9797

From a U(0,1) in the following table:

U	0.2523	0.8757	0.7373	0.1365	0.2987	0.8939	0.4692
X							

9-* Simulate random variable *X* with geometric distribution and *p=0.1* from *U(0,1)=0.5

(Hint: See page 93 Eq. 5.4)

10%

X=

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