Simulation Exam **Name:** **University of the Ryukyus**
3-rd year undergraduate **No:** **Faculty of Engineering**
2011-2-4 Last Term Examination **Department of Information Eng.**
Time: 90 minutes (write answers in boxes) **Prof. M.R. Asharif**

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1- **If $y=x^2$ and x is a random variable with the normal p.d.f , that is:**

$$f(x)=\frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}x^2}$$

Then, find the probability density function (p.d.f) of random variable, y: f(y).

10%

(*Hint: See page 33*)

f(y) =

2- **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]=*** $q^{i-1}p$

(Hint: See page 38) *10%*

Pr[S=K]=

3- **In Randomised Response Technique (RRT), if we have:**

Pr[Yes|N]=0.2 (answering probability to non-embarrassing question).

Pr[Yes]=0.6 (total probability from survey).

p_0 =0.5 **(**probability for answering to non-embarrassing question).

Find Pr[Yes|E]=*?* (answering probability to embarrassing question).

(Hint: See page 51) *10%*

Pr[Yes|E]=

4-**The first pseudo-random number generator proposed by Von Neuman (1951) was the "mid-square (MS)" such that:**

X(0)=7777 , x(1) = MS(7777)=Mid(7777)^2 =60<u>4817</u>29=4817

Find the first five numbers.

x(0)=7777 , x(1)= 4817 ,x(2)= ,x(3)= ,x(4)= ,x(5)=

10%

(Hint: See page 71)

***5*- In the following iterative function:** *10%*

$$a(n+1)=[a(n)]^2-0.75$$

If $a(0)=0.5i$, where $i=\sqrt{-1}$, find the attractor of this function, $a(\infty)$.

(*Hint: See Julia Sets*)

a(∞)=

6*- Simulate the normal distributed random variables *(N1, N2)* by using Box-Muller method from the following pair of uniform distributed random variables: *(U1,U2)=(0.8825,0.5) *(Hint: See page 78 use Eq. 4.1)*

10%

(N1,N2)=

***7*- Simulate the Gamma distributed random variables, G, with $\Gamma(n,\lambda)$ for n=5, $\lambda = 0.25$ from the following uniform distributed random variables, U(0,1):**
U1=0.9, U2=0.8, U3=0.7, U4=0.81, U5=0.9 *10%*

(*Hint: See page 82*)

G=

***8*- Two independent uniform random numbers with U(0,1) are given in the binary form as below: U1=0.10101010**
U2=0.01111011
Simulate the binomial distribution B(8,1/2) random variables, X1, from U1 and X2, with B(8,1/4) from U1 and U2. *10%*

(*Hint: See page 83*)

X1= X2=

9*- Simulate random variable *X* with geometric distribution and *p=0.2*from *U(0,1)=0.74

(Hint: See page 93 Eq. 5.4)

X=

10%

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9- 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 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 =

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