Org. JV

Simulation
3-rd year undergraduate
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Time: 90 minutes

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Hints:

page 33 1- Derive the density function of the random variable X where:

$X = -\log_e U$ with U(0,1) 10%

$f_X(x) = f_U(u)\left|\frac{du}{dx}\right|$ | $u = e^{-x}$

$\frac{dx}{du} = -\frac{1}{u}$ | $f_u(x) = e^{-x}$

$f_u(x) = 1 \times u = u$

f(x)= e^{-x}

page 275 2- If the joint distribution: $f_{xy}(x,y) = 24xy$ for: x+y=1 x,y>0

Investigate that X,Y are independent or dependent random variables. 20%

$f_X(x) = \int_0^{1-x} 24xy\,dy = 12xy^2\Big]_0^{1-x} = 12x(1-x)^2$

$f_Y(y) = \int_0^{1-y} 24xy\,dx = 12y(1-y)^2$

Independent
(Dependent)

$f_{xy}(x,y) \neq f_X(x) \cdot f_Y(y) \longrightarrow$ x and y are dependent

page 61 3- The mixed congruential generator: $x_{n+1} = 17x_n + 3 \pmod 8$

has full (8) cycle length. With seed $x_0 = 1$ generate all cycle one after each.

x(0)=1, x(1)= 4, x(2)=7, x(3)=2 ... $x_4=5$, $x_5=0$, $x_6=3$, $x_7=6$ 10%

page 80 4- Find the normal distributed random variables (N1, N2) by using Polar- Marsaglia method (rejection method) from each pair of the following uniform distributed random variables:

(V1,V2)=(0.1,0.3), (V1,V2)=(0.9,0.8), (V1,V2)=(0.6,0.8) 20%

(N1,N2)=(2.034, 0.678), (N1,N2)= rejected, (N1,N2)= (0, 0)

$W = V_1^2 + V_2^2 = 0.01 + 0.09 = 0.1 < 1$

$N_1 = V_2\left(\frac{-2\log_e W}{W}\right)^{1/2} = 0.3\left(\frac{2 \times 2.3}{0.1}\right)^{\frac{1}{2}} = 2.037$

$N_2 = V_1\left(\frac{-2\log_e W}{W}\right)^{\frac{1}{2}} = 0.678$

page 83 5- Two independent uniform random numbers with U(0,1) are given in the binary form as below: U1=0.10110010

U2=0.01101010

Find the binomial distribution B(8,1/2) random variables X1 from U1 and X2 with B(8,1/4) from U1 and U2.

X1= 4
X2= 2 20%

palce by place multiplication = 0.00100010

page 92,93 6- Find random variable X with geometric distribution and p=0.5 from U(0,1)=0.3

$X = 1 + \left[\frac{\log_e U}{\log_e (1-p)}\right]$ X= 2 20%

$X = 1 + \left[\frac{\log_e 0.3}{\log_e 0.5}\right] = 1 + \left[\frac{-1.2}{-0.7}\right]$

$X = 1 + [1.714] = 2$