Scheme of Evaluation
Internal Assessment Test 2 – June.2021

Sub:	System Modeling and Simulation							Code:	17CS834
Date:	20/06/2021	Duration:	90mins	Max Marks:	50	Sem:	VIII	Branch:	ISE

Note: Answer Any Five Questions

Question #		Description	Marks Distribution		Max Marks
1		• Finding E value, E=N/n • Chi-Square test computational table • Justification of acceptance/rejection	2 M 7 M 1 M	10 M	10 M
2		• Finding the M value i.e. i+(M+1)l <= N • Finding the ρim value i.e. ρim =1/M+1[Ri+km *Ri+(k+1)m] -0.25 • Finding the σρim = sqrt(13M+7) / 12(M+1) value • Justification of acceptance	2 M 4M 2M 2M	10 M	10 M
3	a)	• Set n=0, p=1. • Taking the first random number and finding p value • Comparing p with $e^{-\alpha}$, if p< $e^{-\alpha}$ accept N=0,else reject and go to step2 Repeating the above steps for all random numbers and finding acceptance/rejection	2 M 4 M	6 M	10 M
	b)	• Finding the CDF F(x) • Set F(x)=R and solving the equation in terms of X	1 M 3M	4 M	
4		• Finding a1,a2.....a7 • Finding E0 to E11 • Finding observed values • Chi-Square test table • Justification of Acceptance/Rejection	1 M 1 M 2 M 5 M 1 M	10 M	10 M
5		• Poisson variate calculation P(1),P(1),...P(10) • Finding E1, E1,….. till E10 • Chi-Square test table • Justification of Acceptance/Rejection	1 M 1 M 6 M 2 M	10 M	10 M

6	a)	• Four methods to select input model without data: i)Engineering data ii) Expert Option iii) Physical or Conventional Limitations iv)The nature of Process along with explanation	1.25*4 =5 M	5 M	10 M
	b)	• Types of simulations w.r.t output analysis. • Explanation of Terminating simulation with examples • Explanation of Non-Terminating simulation with examples	1 M 2M 2 M	5 M	

Internal Assessment Test 2 Solutions– June.2021

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Note: Answer Any Five Questions

1.

- Dividing into no of intervals
- Finding Ei value

  Ei= N/n = 100/10 =10
- Chi-Square test computation table

Interval No	Interval range	Oi	Ei	Oi-Ei	$(Oi-Ei)^2$	$(Oi-Ei)^2/Ei$
1	0-0.1	9	10	-1	1	0.1
2	0.1-0.2	8	10	-2	4	0.4
3	0.2-0.3	10	10	0	0	0
4	0.3-0.4	9	10	-1	1	0.1
5	0.4-0.5	12	10	2	4	0.4
6	0.5-0.6	8	10	-2	4	0.4
7	0.6-0.7	10	10	0	0	0
8	0.7-.0.8	13	10	3	9	0.9
9	0.8-0.9	10	10	0	0	0
10	0.9-1.0	11	10	1	1	0.1
Total						**2.4**

- Comparing with α value and justifying for acceptance/rejection

  i.e.2.4 < 16.9 so the above values are accepted

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2) **Solution:** Finding the autocorrelation value along with steps

- Finding the M value

  i.e. i+(M+1)m <= N
- Here i=3, m= 5 and N=60

i.e. 3+(M+1)5 <= 60.For M=11 this condition won't satisfy so the previous value is M=8.

- Finding the ρ_{im} value

i.e. ρ_{im} = 1/M+1[R3.R8+R8.R13+R13.R18+R18.R23+R23.R28+R28.R33+R33.R38+R38.R43+R43.R48+R48.R53+R53.R58] - 0.25

=1/11[(0.36)(0.06)+(0.06)(0.14)+(0.14)(0.60)+(0.60)(0.37)+(0.37)(0.79)+(0.79)(0.41)+(0.41)(0.06)+(0.06)(0.13)+(0.13)(0.25)+(0.25)(0.76)+(0.76)(0.19)] – 0.25

= -0.12713

- Finding the $\sigma_{\rho im}$ = 13M+7 / 12(M+1) value
  =13*10+7 / 12(11) = 0.0886

- Finding Z_0 value
  i.e. Z_0 = -0.12713/0.0886 = -1.4345

➢ Justification of acceptance
i.e. $-Z_{\alpha/2} <= Z_0 <= Z_{\alpha/2}$
= -1.96 < -1.4345 <1.96.Hence the sequence of numbers given are accepted

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3.a)

1. Set n=0,p=1.
2. R1=0.4357,P=1*0.4357 = 0.4357
3. Since P=0.4357 > e^{-4} = 0.0183, reject n=0 and return to step 2 with n=1.
2. R2=0.4146 , p= 0.4146 * 0.4357 =0.1806
3. Since 0.1806 > 0.0183, reject n=1 and return to step 2 with n=2.
2. R3= 0.8353, p=0.8353*0.1806 = 0.1508
3. 0.1508 > 0.0183, reject n=2 and return to step 2 with n=3.
2. R4= 0.9952, p=0.9952*0.1508 = 0.1502
3. 0.1502 > 0.0183, reject n=3 and return to step 2 with n=4.
2. R5= 0.8004, p= 0.8004 * 0.1502 = 0.1202
3. 0.1202 > 0.0183,reject n=4 and return to step 2 with n=5.
2. R6= 0.7945, p=0.7945 * 0.1202 = 0.0955
3. 0.0955 > 0.0183, reject n=4 and return to step 2 with n=6.
2. R7= 0.1530, p=0.1530 * 0.0955 = 0.0146
3. 0.0146 < 0.0183, accept N=6

The variates are as follows.

n	Rn+1	p	accept/reject	Result
0	0.4357	0.4357	reject	n=1
1	0.4146	0.1806	reject	n=2
2	0.8353	0.1508	reject	n=3
3	0.9952	0.1502	reject	n=4
4	0.8004	0.1202	reject	n=5
5	0.7945	0.0955	reject	n=6
6	0.1530	0.0146	accept	N=6

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3. b)

1. Compute the CDF, i.e. F(x) = $1-e^{\acute{\alpha}x}$
2. Set F(x)=R in the range of X $1-e^{\acute{\alpha}x}$ = R
3. Solve F(x) in terms of X $1-e^{\acute{\alpha}x}$ = R

$-^{\acute{\alpha}}x = \ln(1-R)$, $X=-1/^{\acute{\alpha}}\ln(1-R)$

X is called random variate

4)

Sol:

- Finding P value **– 1Mark**
  - P=1/k = 1/7 = 0.143 λ = 1/x = 0.816

- Finding Expected Values – **1 Mark**
  - Ei=nPi=50*0.143 = 7.14

- Finding A0,A1,….values – **2 Marks**

  Ai=-1/λ ln(1-iP)

  A0=-1/0.816 ln(1-0*0.143)=0

  A1=-1/0.816 ln(1-1*0.143) = 0.19

  A2= -1/0.816 ln(1-2*0.143) = 0.41

  A3= -1/0.816 ln(1-3*0.143) = 0.69

  A4= -1/0..816 ln(1-4*0.143) = 1.04

  A5 = -1/0.816 ln(1-5*0.143) = 1.54

  A6 = -1/0.816 ln(1-6*0.143) = 2.39

- Chi-square table – **5 Marks**

Interval	Oi	Ei	Oi-Ei	(Oi-Ei)2	(Oi-Ei)2/Ei
0-0.19	7	7.14	-0.14	0.019	0.002
0.19 - 0.41	10	7.14	2.86	8.179	1.145
0.41 - 0.69	6	7.14	-1.14	1.299	0.182
0.69 – 1.04	7	7.14	-0.14	0.019	0.002
1.04 - 1.54	6	7.14	-1.14	1.299	0.182
1.54 – 2.39	7	7.14	-0.14	0.019	0.002
2.39 - ∞	7	7.14	-0.14	0.019	0.002
				Total	**1.517**

- Justification of acceptance – **1 Mark**
  - 1.517< 9.49 so the data given are accepted.

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5)

Solution:

For Poisson distribution $P(x) = e^{-\alpha}\alpha^{x} / x!$ for x=0,1,2,…..

$\alpha = \bar{X}$ = (1*8)+(2*6)+(3*10)+(4*11)+(5*12)+(6*8)+(7*10)+(8*12)+(9*12)+(10*11)/100 = 5.86

Compute P(1),P(2),……P(10) as follows

$P(1)= e^{-4}(4)^{1} / 1! = 0.017$ E1=100*0.017= 1.7
$P(2)= e^{-4}(4)^{2} / 2! = 0.049$ E2= 100*0.049 = 4.9
$P(3)= e^{-4}(4)^{3} / 3! = 0.096$ E3= 100* 0.096 = 9.6
$P(4)= e^{-4}(4)^{4} / 4! = 0.140$ E4= 100*0.140 = 14
$P(5)= e^{-4}(4)^{5} / 5! = 0.164$ E5= 100*0.164 = 16.4
$P(6)= e^{-4}(4)^{6} / 6! = 0.160$ E6 = 100*0.160 = 16
$P(7) = e^{-4}(4)^{7} / 7! = 0.134$ E7 = 100 * 0.134 = 13.4
$P(8) = e^{-4}(4)^{8} / 8! = 0.098$ E8 = 100* 0.098 = 9.8
$P(9) = e^{-4}(4)^{9} / 9! = 0.064$ E9 = 100* 0.064 = 6.4
$P(10)= e^{-4}(4)^{10} / 10! = 0.038$ E10= 100*0.038= 3.8

Xi	Oi	Adding Oi<5	Ei	Adding Ei<5	(Oi-Ei)2/Ei
1	8	14	1.7	6.6	8.29
2	6		4.9		
3	10		9.6		0.02
4	11		14		0.64
5	12		16.4		1.18
6	8		16		4
7	10		13.4		0.86
8	12		9.8		0.49
9	12	23	6.4	10.2	16.06
10	11		3.8		
Total	100				31.54

In the above table since E4,E5 and E6 are less than 5, we have combined with E3 so that it becomes greater than 5. If we are combining Ei then we need to combine Oi also as above.

Here $X^2_{\alpha,K-S-1 = 8-1-1 =6}$

K = No of intervals divided, S= No of parameters estimated i.e only α is given

$X^2_{0.05,6} = 5.99$

- Justification of acceptance

The computed value 31.54 > 5.99 so the hypothesis is rejected.

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6)a)

Engineering data: Often a product or process has performance ratings provided by the manufacturer.

Expert option: Talk to people who are experienced with the process or similar processes. Often they can provide optimistic, pessimistic and most likely times.

Physical or conventional limitations: Most real processes have physical limit on performance. Because of company policies, there may be upper limits on how long a process may take. Do not ignore obvious limits or bound: that narrow the range of the input process.

The nature of the process : It can be used to justify a particular choice even when no data are available.

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6)b)

Terminating verses non-terminating simulations

• Terminating simulation:

1. Runs for some duration of time TE, where E is a specified event that stops the simulation.
2. Starts at time 0 under well-specified initial conditions.
3. Ends at the stopping time TE.
4. Bank example: Opens at 8:30 am (time 0) with no customers present and 8 ofthe 11 teller working (initial conditions), and closes at 4:30 pm (Time TE = 480 minutes).
5. The simulation analyst chooses to consider it a terminating system because the object of interest is one day‘s operation.
