

Candidates are required to give their answers in their own words as far as practicable

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Describe in brief the different types of simulation models. Taking an example of any realistic simulation problem, illustrate the concepts of system boundary, environment, entities, endogenous and exogenous activities. 8
- b) Solve the following using Monte Carlo Simulation. Use 15 iteration to generate the number. Also estimate the error percentage. 7
2. a) Compare simulation and analytical methods with example. 8
- b) Define differential equation. Explain why it is required in continuous system simulation. Explain the types of differential equation with example. 7
3. a) Derive and write the CSMP-III program for Predator-Prey model. 8
- b) What is the significance of incorporating delayed calls in a telephone system simulation? Provide a detailed description of the simulation involving these delayed calls and how they impact the overall system performance. 7
4. a) Explain different gathering statistics the counter and summary statistics and the measuring utilization and occupancy. 7
- b) Use the Kolmogorov-Smirnov test to determine whether the given sequence is a sequence of uniform random numbers at 95% level of significance. 8

0.26, 0.66, 0.75, 0.38, 0.61, 0.98, 0.31, 0.90, 0.88, 0.65

1 6 7 3 4 10 2 9 8 5

5. a) From the below given Random numbers check its uniformity using chi-square method for 95% accuracy.

1 2 3 4 5 6 7

(Use standard table for appropriate value.)

194 128 30 179 176 181 138 180 128 154 129 119 160 101 142 145.
182 193 186 145 130 150 186 104 102 106 148 102 132 160 121.
170 100 12 159 132 176 153 183 156 125 123 105 195 137 106 171.
193 108 185 134 195 155 124 189 197 158 167 105 130 161 192 130.
195 164 107 177 134 178 102 169 112 176 106 157 139 150 193 181.
164 136 109 171 155 129 114 118 133 134

A machine tool in a manufacturing shop is turning out parts at a rate of one every 8 minutes. As they are finished, the parts go to an inspector, who takes 6+3 minutes to examine each one and rejects about 20 % of the parts. The rejected parts are then sent for further refinement. Reworking takes 10+3 minutes. After correction all the parts are resubmitted for inspector. Simulate for 500 parts to be completed. Draw GPSS block diagram and write GPSS code.

6. a) Define SIMSCRIPT program. Explain organization of SIMSCRIPT statement.

7

- b) How would you use replication of runs to calculate means, variances and confidence intervals of output parameters? Describe.

8

7. Write short notes on: (Any two)

2x5

- a) Elimination of initial bias
b) Generation of arrival patterns
c) Queuing System

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Level: Bachelor
Programme: BE
Course: Simulation and Modelling

Semester: Spring

Year : 2021
Full Marks: 100
Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

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Attempt all the questions.

- a) What is Simulation and Model? Explain about the areas where simulation can be applied. 7
- b) Can you estimate the value of π ? Explain its method and steps for estimation. 8
2. a) What do you mean by time advance mechanism? Differentiate between next event and fixed increment time advance mechanism. 7
- b) Describe in brief predator prey model. Explain the structure of CSMP III. 4+4
3. a) How nonlinear differential equation can be used to represent continuous system? Explain with example. 7
- b) What are the various arrival patterns in representing discrete system? Explain about simulation programming task. 3+5
4. a) Justify the statement "Call gets lost when link is not available or line is busy" with the help of telephone simulation system. 7
- b) A sequence of random numbers is given below. Use chi-square test with $\alpha=0.05$ to test whether these numbers are uniformly distributed and serial autocorrelation. (Use $\chi^2_{0.05,7} = 14.067$) 8
~~49, 95, 82, 19, 41, 31, 12, 53, 62, 40, 87, 83, 26, 01, 91, 55, 38, 75, 90, 35, 71, 57, 27, 85, 52, 08, 35, 57, 88, 38, 77, 86, 29, 18, 09, 96, 58, 22, 08, 93, 85, 45, 79, 68, 20, 11, 78, 93, 21, 13, 06, 32, 63, 79, 54, 67, 35, 18, 81, 40, 62, 13, 76, 74, 76, 45, 29, 36, 80, 78, 95, 25, 52.~~
5. a) Explain the organization of SIMSCRIPT program with suitable diagram. 7
- b) Consider a factory that manufacture football taking 20 to 40 minutes. The ball is moved from the generation to the inspection machine taking 2 minutes. There are 3 inspection machines at one place and need 30 to 8

60 minutes for inspection and reject 30% of the football. Simulate for 1000 transaction. Draw GPSS block diagram to simulate this system:

6.
 - a) How can we analyze the output that is generated from iid variables? Explain.
 - b) Replication of runs can be used to analyze the result that is generated from multiple runs. Explain in detail about it.
7. Write short notes on: (Any two)
 - a) Pseudo random number
 - b) Queue Characteristics
 - c) Real time Simulation

Level: Bachelor

Programme: BE

Course: Simulation and Modeling

Semester: Fall

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Attempt all the questions.

1. a) "Before system simulation, it is necessary to predict how a system performs its activities". Explain this with the principles of system modeling. 7
1. b) Why do we need the Monte-Carlo method of simulation? Estimate the value of π using Monte-Carlo simulation. Use 15 iterations to generate numbers. Compare your result with its known value up to 3 decimal places. 8
2. a) Discuss about continuous system Simulation Language (CSSL). Explain different components of analog methods. 8
2. b) Draw the Cobweb model (in graph) for market economy graph from the given data 7
 $D = 12.4 - 1.2P$
 $S = 8.0 - 0.6P$
 $D = S$ and $P_0 = 1.0$
3. a) Write a program in CSMP III for the RLC circuit model given by the following differential equation (variable and constants have their appropriate meaning). 8
$$Mx'' + Dx' + Kx = KF(t)$$

Where $M = 2.0$, $F = 1.0$ and $K = 400.0$. Make your necessary assumptions if required.
3. b) What is the significance of lost calls in a telephone system simulation ? How do you measure the utilization and occupancy of a link in telephone system simulation ? Explain 7
4. a) Why do we need to gather statistics in discrete system simulation ? Explain the recording distribution and transit time. 7

- b) How do you generate arrival pattern using bootstrap sampling? 8
5. a) For the given sequence of random numbers, can the hypothesis that the numbers are rejected on the basis of length of runs up and down at $\alpha = 0.05$? 8
- | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| 0.41 | 0.68 | 0.89 | 0.94 | 0.74 | 0.91 | 0.55 | 0.62 | 0.36 | 0.27 |
| 0.19 | 0.72 | 0.75 | 0.08 | 0.54 | 0.02 | 0.01 | 0.36 | 0.16 | 0.28 |
| 0.18 | 0.01 | 0.95 | 0.69 | 0.18 | 0.47 | 0.23 | 0.32 | 0.82 | 0.53 |
| 0.31 | 0.42 | 0.73 | 0.04 | 0.83 | 0.45 | 0.13 | 0.57 | 0.63 | 0.29 |
| 0.41 | 0.68 | 0.89 | 0.94 | 0.74 | 0.91 | 0.55 | 0.62 | 0.36 | 0.27 |
| 0.19 | 0.72 | 0.75 | 0.08 | 0.54 | 0.02 | 0.01 | 0.36 | 0.16 | 0.28 |
| 0.18 | 0.01 | 0.95 | 0.69 | 0.18 | 0.47 | 0.23 | 0.32 | 0.82 | 0.53 |
| 0.31 | 0.42 | 0.73 | 0.04 | 0.83 | 0.45 | 0.13 | 0.57 | 0.63 | 0.29 |
- b) How do you define random numbers in the domain of computation? Explain with a random number generation algorithm 7
6. a) A parts manufacturing shop is turning out parts at the rate of one every 5 minutes. As they are finished, the parts go to the inspectors, who take 4 ± 3 minutes to examine each one and rejects about 10% of the parts. There are three inspectors. During examination, the parts are put on a conveyor, which carries the parts to the inspectors and takes defined interval of time in between. It takes 2 minutes for a part to reach the first inspector; if he is free at the time of part arrives, he takes it for inspection. If he is busy at that time, the part takes a further 2 minutes to reach the second inspector who will take the part if he is not busy. Parts that pass the second inspector may get picked up by the third inspector, who is a further 2 minutes along the conveyor belt; otherwise they are lost. Each part will be represented by one transaction and the time unit selected for the problem will be 1 minute.
- Write a GPSS block diagrams and a program for the system.
- b) How do you define the initial bias in a system simulation? How does the replication of runs help to minimize it? 7
7. Write short notes on: (Any two) 2x5
- Estimation Methods
 - Digital-Analog Simulator
 - Queuing system

POKHARA UNIVERSITY

Level: Bachelor
 Programme: B E
 Course: Simulation and Modeling

Semester: Fall

Year : 2020
 Full Marks: 100
 Pass Marks: 45
 Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What is Simulation and Model? Explain various models that are involved while simulating system. 7
- b) How performance of a single server queue can be measured? Explain in detail. 8
2. a) Explain the numerical computation techniques for continuous Model. 7
- b) Draw the cobweb model (in graph) for :
 i) Fluctuation of market price.
 ii) Cobweb model for market economy graph from given data.
 $D = 12.4 - 1.2 P$, $S = 8.0 - 0.6 P_1$, $D = S$, $P_0 = 1.0$ 8
3. a) What is an analog method? Design an analog computer for human liver. The equations for human liver are 7

$$\begin{aligned} dx_1/dt &= -k_{12}x_1 + k_{21}x_2 \\ dx_2/dt &= k_{12}x_1 - (k_{21} + k_{23})x_2 \\ dx_3/dt &= k_{23}x_2 \end{aligned}$$
- b) Explain about the simulation of an automobile wheel with CSMP III program for it. 8
4. a) How is statistics gathered in simulation? Explain with reference to telephone system. 8
- b) Calls are lost when lines are busy or link is not free. Explain various steps involved to simulate this system. 7
5. a) Define pseudo random numbers. The following numbers have been generated 0.44, 0.19, 0.88, 0.27, 0.55, 0.13, 0.63, 0.74, 0.11 and 0.33. Use the Kolmogorov-Smirnov Test with $\alpha=0.05$ to determine, if the 7

hypothes is that the numbers are uniformly distributed on interval [0, 1] can be rejected. [Use the critical value of D for $\alpha = 0.05$ and $N=10$ is 0.410.]

- b) A sequence of random numbers is given below. Use chi-square test with $\alpha=0.05$ to test whether these numbers are serially auto correlated.(Use $\chi^2_{0.05,7} = 14.067$) 8

49, 95, 82, 19, 41, 31, 12, 53, 62, 40, 87, 83, 26, 01, 91, 55, 38, 75, 90, 35, 71, 57, 27, 85, 52, 08, 35, 57, 88, 38, 77, 86, 29, 18, 09, 96, 58, 22, 08, 93, 85, 45, 79, 68, 20, 11, 78, 93, 21, 13, 06, 32, 63, 79, 54, 67, 35, 18, 81, 40, 62, 13, 76, 74, 76, 45, 29, 36, 80, 78, 95, 25, 52.

6. a) What are DSSLs? Explain GPSS with example to solve discrete system problem. 8
- b) Write a SIMSCRIPT program for MAIN routine of the telephone system 7
7. Write short notes on: (Any two) 2x5
- a) Elimination of initial bias.
 - b) Replication of Run.
 - c) Differential Equations.

Level: Bachelor

Programme: BE

Course: Simulation and Modeling

Semester: Fall

Year : 2019

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

*The figures in the margin indicate full marks.
Attempt all the questions.*

1. a) What is a model? Explain different types of model with suitable example. 8
b) Explain various principles used in modelling. 7
2. a) What do you understand by time-advance mechanism? Explain its types briefly. 7
b) What are the advantages and disadvantages of Monte Carlo method? Estimate the value of pi using Monte Carlo method. 8
3. a) Describe the importance of partial differential equations in simulation. 8
Explain hybrid computers.
b) Simulate Autopilot system and write CSMP code for it. 7
4. a) When line is busy or link is not available, call cannot be connected and hence the call gets lost. Explain the scenario with the states involving each condition. 8
b) How are utilization and occupancy measured in simulation? Explain with reference to telephone system. 7
5. a) A quality control chart has been maintained for the weights of paint cans taken from a conveyor belt at a fixed point in a production line. Sixteen (16) weights obtained today, in order of time, are as follows: 8

68.2	71.6	69.3	71.6	70.4	65.0	63.6	64.7
65.3	64.2	67.6	68.6	66.8	68.9	66.8	70.1

Use the run test, at approximately a 0.015 level, to determine whether the weights of the paint cans on the conveyor belt deviate from randomness.[Given: $Z_{0.025}=1.96$] 7

- b) What are the two desired properties of pseudo random numbers?
Generate random numbers using Linear Congruential method with $x_i=27$,

$a=17$, $c=43$ and $m=100$ and test their uniformity using Kolmogorov-Smirnov test with 5% level of significant. [Given: $D_{0.05}=0.565$]

6. a) Explain different types of BLOCKS in GPSS. 8
b) Why do we need analysis of simulation output? Explain the replication of run. 7
7. Write short notes on: (Any two) 2x5
- a) Real Time Simulation
 - b) Elimination of Initial bias
 - c) Components of queuing system

POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Simulation and Modeling

Semester: Spring

Year : 2019

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

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Attempt all the questions.

1. a) What is system environment? Explain with reference to open and close system? 7
- b) Why Monte-Carlo method is best method for computing static model? 8
 Use it to solve $\int_2^5 x^2 \cdot dx$ using twenty samples.
2. a) What do you understand by time advancement mechanism? Explain its types briefly. 7
- b) What are the steps to be taken in simulation? Explain with neat diagram. 8
3. a) Explain Predator Pray Model with example. 8
- b) When there is no line available or all the links are busy calls get lost. Show all the necessary steps for block and busy condition in telephone call simulation. 7
4. a) What are the various components and organization of a discrete system? Explain them. 7
- b) If same process is repeated for multiple runs, which of the analysis method is used and how? 8
5. a) The following numbers have been generated 0.39, 0.67, 0.78, and 0.55. Use the Kolmogorov-Smirnov Test to check whether given numbers are uniformly distributed or not. (Use the critical value of D for $\alpha = 0.05$ and $N=5$ is 0.565.) 7
 b) The two Digit random numbers generated by a multiplicative congruential method are given below. Test these data for uniform distribution using Chi-square. Is it acceptable at 95% confidence level? (Use $\chi^2 0.05, 9 = 16.9$) 8
 36, 91, 51, 02, 54, 06, 58,
 06, 58, 02, 54, 01, 48, 97, 43, 22,
 83, 25, 79, 95, 42, 87, 73, 17, 02,
 42, 95, 38, 79, 29, 65, 09, 55, 97,
 39, 83, 31, 77, 17, 62, 03, 49, 90,

37, 13, 17, 58, 11, 51, 92, 33, 78,
21, 66, 09, 54, 49, 90, 35, 84, 26,
74, 22, 62, 12, 90, 36, 83, 32, 75,
31, 94, 34, 87, 40, 07, 58, 05,
56, 22, 58, 77, 71, 10, 73, 23, 57, 13,
36, 89, 22, 68, 02, 44, 99, 27,
81, 26, 85, 22

6. a) Why is analysis of simulation output necessary? How is it done in 7
replication of run?
b) Write SIMSCRIPT code for arrival routine of telephone call 8
simulation.
7. Write short notes on: (Any two) 2x5
a) Feedback System
b) Differential Equations
c) Measure of queuing system

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Attempt all the questions.

- a) What is simulation and modeling? Briefly explain its application. 8
- Why is simulation considered as "The Last Resort"? 7
- b) What is system simulation? Discuss with examples why some systems are not appropriate to simulate? 8
- a) What are the drawbacks of Monte Carlo method? Estimate the value of pi using the Monte Carlo method. Also calculate the error percentage. 8
- b) What is analog computer? Describe its merits and demerits. 7
3. a) Explain the data and control statements in CSMP III. Explain with example. 8
- b) Differentiate between event oriented and interval oriented time advance mechanism. 7
4. a) What is lost call? How can we maintain the calls from being lost? 7
- Simulate the telephone system for such calls (Delayed calls). 8
- b) Write the algorithm for K-S uniformity test. Use multiplicative congruent method to generate a sequence of four-three-digit random number with seed=117, multiplier=43 and modulus=1000. 8
5. a) What is DSSI? Write GPSS block diagram for manufacturing shop model when there is single inspector and single transaction can be handled at a time. 7
- b) How temporary entities, permanent entities and variables can be declared using SIMSCRIPT language. 7
6. a) When same process is repeated multiple times replication of runs is used to analysis the output. Explain it. 7

- b) "Initial bias decreases the efficiency of the system." Illustrate the statement with its solution.

Write short notes on: (Any two)

- a) Distributed Lag Model
- b) Bootstrapping arrival pattern
- c) Pseudo Random Number

POKHARA UNIVERSITY

Level: Bachelor
 Programme: BE
 Course: Simulation and Modeling

Semester: Spring

Year : 2018
 Full Marks: 100
 Pass Marks: 45
 Time : 3hrs.

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Attempt all the questions.

- | | |
|--|---|
| a) What is a model? Explain different types of model in simulation study. | 7 |
| b) Discuss the concept and methodology of Monte Carlo Method. | 8 |
| a) Draw the cobweb model (in graph) for market economy graph from the given data. | 8 |
| $D = 12.4 - 1.2P$ | |
| $S = 8.0 - 0.6P_{-1}$ | |
| $D = S \text{ and } P_0 = 1.0$ | |
| b) What is continuous system? How differential equation can be used to represent continuous system? Explain with example. | 7 |
| a) Write a CSMP-III program for $A = \int_0^4 \sqrt{16 - x^2} dx$ where $\theta = \frac{Q}{V}$ and assume necessary data. | 7 |
| b) Make the necessary assumptions and model telephone call simulation when call gets listed if the line is busy. | 8 |
| a) Differentiate between trace driven and Boot strapping method. What are the simulation programming task? | 7 |
| b) For the given sequence of random numbers, can the hypothesis that the numbers are independent be rejected on the basis of length of runs up and down at $\alpha=0.05$? | 8 |

0.41	0.68	0.89	0.94	0.74	0.91	0.55	0.62	0.36	0.27
.19	0.72	0.75	0.08	0.54	0.02	0.01	0.36	0.16	0.28
0.18	0.01	0.95	0.69	0.18	0.47	0.23	0.32	0.82	0.53
0.31	0.42	0.73	0.04	0.83	0.45	0.13	0.57	0.63	0.29

5. a) Discuss the concept of SIMSCRIPT Program. Explain the organization of SIMSCRIPT Program. 7
- b) There are 48 people in a institute studying programming. They all started writing a program at the same time. It takes each student 15 (+ -) 3 minutes to write the program. Only 35% of the program will run correctly for first time. When program has a error it takes 4 (+ -) 2.5 minutes to do the de-bugging. After de-bugging only 35% of the program will run successfully. How long does it take for whole class to finish every ones program correctly? Simulate the given program with block diagram and code of GPSS. 8
6. a) How does initial bias make an adverse effect? Discuss about the process of eliminating initial bias. 7
- b) What is the method used when the simulation is repeated multiple times? 8
7. Write short notes on: (Any Two): 2×5
- a) SSQM
 - b) Measuring utilization and occupancy
 - c) Real time simulation