

POKHARA UNIVERSITY

Level: Bachelor
 Programme: BE
 Course: Simulation and Modeling

Semester - Fall

Year : 2012
 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.

- a) What is Simulation and Modeling? Explain the principle used in Simulation and Modeling. 8
 b) Mention the system, entities, attributes and activities of the following table. 7

TRAFFIC	SPEED DISTANCE	CARS	DRIVING
BANK	BALANCE CREDIT STATUS	CUSTOMERS	DEPOSITING
COMMUNICATIONS	LENGTH PRIORITY	MESSAGES	TRANSMITTING
SUPERMARKET	SHOPPING LIST	CUSTOMERS	CHECKING POINT

Explain any one system with suitable example using the entities, attributes and activities.

OR

Find the value π using the Monte Carlo method. 7

- a) Discuss about Digital-Analog simulator? What was the reason to develop CSSLs? Explain the structure of CSMP-III. 8
 b) Design an analog computer from the following electrical circuit system: $MX'' + DX' + KX = F(t)$ 7
 c) Differentiate between fixed and next event time advance mechanism. Which mechanism is mostly used and why? 8

OR

Why do we need to gather statistics in discrete system simulation?
 Explain recording, distribution and transit time 7

- b) When line is busy or link is not available, call cannot be connected and the call gets lost. Explain the various states involving each condition. 7

4. a) How arrival pattern are generated in discrete system simulation? Explain. 8
 b) Why do we need statistical method? Explain estimation method with derivation. 7
 5. a) Why do we replicate the simulation run? Explain with a derivation. 7
 b) Explain simulation of manufacturing shop having more than one inspector with help of GPSS block diagram. 8
 6. a) Write the format and example of SIMSCRIPT statements for
 i. Defining event with parameter
 ii. Defining event without parameter 7

OR

Explain the concept of System SIMSCRIPT.

- b) What is DSSLs and CSSLs? Explain various GPSS blocks that can be used to solve discrete system. 8
 7. Write short notes on any two: 2x5
 a) Advantages of Simulation
 b) Hybrid Simulation
 c) Elimination of Bias

POKHARA UNIVERSITY

Level: Bachelor	Semester: Fall	Year : 2013
Programme: BE		Full Marks: 100
Course: Simulation and Modeling		Pass Marks: 45
		Time : 3hrs.

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Attempt all the questions.

- | | |
|---|-----|
| 1. a) Solve the following using Monte Carlo simulation.
Integrate : $\sin x \cos x \, dx$ $0 \leq x \leq \pi / 2$ | 7 |
| b) What is continuous system? Explain the role of differential equations in continuous system simulation with suitable example. | 8 |
| 2. a) Define model. What are various principle used in modeling. | 7 |
| b) What is analog computer? Describe its merits and demerits. | 8 |
| 3. a) What is bootstrapping? Describe briefly the simulation of Telephone System with lost call system. Use suitable diagram. | 10 |
| b) Explain the role of gathering statistics in discrete simulation with suitable examples in brief. | 5 |
| 4. a) Illustrate and explain simulation run statistics. | 8 |
| b) Illustrate and explain replication of run. | 7 |
| 5. a) What is an initial bias? What are various methods to eliminate initial bias? | 7 |
| b) Explain the characteristics of GPSS block diagram. | 8 |
| 6. a) Draw GPSS diagram and write code for manufacturing shop having at least two inspectors. | 7 |
| b) Explain the SIMSCRIPT execution life cycle. | 8 |
| 7. Write short notes on: (Any two) | 2×5 |
| a) Utilization & occupancy. | |
| b) Feedback System. | |
| c) Poisson Arrival. | |

Level: Bachelor
Programme: BE
Course: Simulation and Modeling

Semester: Fall

Year : 2014
Full Marks: 100
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Attempt all the questions.

- a) Simulation has become necessity now days. Do you agree? If yes justify your answer. 7
- b) Monte-Carlo method is numerical computation method. Explain how and use it to determine the value of pi. 8
- a) Explain the step of simulation study. 8
- b) What is continuous system the CSMP-III programming statements with their syntax. 7
- a) Explain Predator- Prey model with example 7
- b) What is SIMSCRIPT? Explain the permanent and temporary SIMSCRIPT entities with suitable example. 8
- a) What is bootstrapping? Describe briefly the simulation of Telephone system with delayed call system with suitable diagram. 10
- b) Explain the role of measuring utilization and occupancy in discrete system simulation. 5
- a) Explain various nature of the system? While performing output analysis initial condition may be bias then actual output, it must be removed. Explain how? 7
- b) For dependent data it is difficult to analysis the output. Which method can we use for dependent data? 8
- a) Explain the different types of BLOCK TYPES and their function. 8
- b) From the below given Random numbers check its uniformity and Independence using chi-square method for 95% accuracy. 7

(Use standard table for appropriate value.)

1045	1011	1023	1046	1026	1026	1013	1023
1031	1044	1047	1004	1018	1045	1006	1000
1025	1018	1033	1027	1044	1044	1021	1025
1003	1042	1024	1033	1010	1044	1047	1027
1034	1027	1026	1029	1011	1003	1028	1029
1028	1016						

OR

- Explain the Types of Simulation Language
7. Write short notes on: (Any two) 2
- a) Differential Equation
 - b) Principle of Modeling
 - c) Properties of Random No.

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2014

Programme: BE

Full Marks: 100

Course: Simulation and Modeling

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Attempt all the questions.

1. a) Why Simulation is better option for the study of the System? Justify "Simulation is termed as The Last Resort". 8
- b) What method is favourable for numerical computation for static model? How can you use it to derive value of pi? 7
2. a) Explain about Single Server Queuing model? What is the performance measure of queues? 7
- b) Explain the Numerical Computation Techniques for Continuous Model. 8
3. a) What is Differential Equation? What are symbols used to represent problem in analog computer? Draw analog diagram for these equations: $3dx^2/dt^2 + 2dx/dt - 3x = 4 f(t)$. 8
- b) When line is busy or link is not available, call cannot be connected and the call gets lost. Explain the various states involving each condition. 7
4. a) How statistics can be gathered in Simulation Programming Task? Explain about measuring utilization and occupancy. 7
- b) Use the chi-square test with $\alpha=0.05$ to test whether the data shown below are uniformly distributed. Critical value for $n=10$ is 16.9. 8

0.34	0.90	0.25	0.89	0.87	0.44	0.12	0.21	0.46	0.67
0.83	0.76	0.79	0.64	0.70	0.81	0.94	0.74	0.22	0.74
0.96	0.99	0.77	0.67	0.56	0.41	0.52	0.73	0.99	0.02
0.47	0.30	0.17	0.82	0.56	0.05	0.45	0.31	0.78	0.05
0.79	0.71	0.23	0.19	0.82	0.93	0.65	0.37	0.39	0.42
0.99	0.17	0.99	0.46	0.05	0.66	0.10	0.42	0.18	0.49
0.37	0.51	0.54	0.01	0.81	0.28	0.69	0.34	0.75	0.49
0.72	0.43	0.56	0.97	0.30	0.94	0.96	0.58	0.73	0.05

0.06	0.39	0.84	0.24	0.40	0.64	0.40	0.19	0.79	0.62
0.18	0.26	0.97	0.88	0.64	0.47	0.60	0.11	0.29	0.78

5. a) There are 48 people in an 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 an 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.
- b) Explain the steps of simulation programming tasks.
6. a) How initial condition biasing can be eliminated?
- b) Explain simulation run statistics. Provide details regarding SSQM.
7. Write short notes on: (Any two)
 - a) Feedback System.
 - b) Nondeterministic System.
 - c) Next event time advance mechanism.

PO KHARA UNIVERSITY

Level: Bachelor
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 Course: Simulation and Modelling

Semester: Spring

Year : 2015
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 Time : 3 hrs.

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 Attempt all the questions.*

1. a) What is Simulation? Why validation and calibration is necessary in simulation? Explain in detail. 7
- b) Draw the cobweb model (in graph) for :
 - i. Fluctuation of market price.
 - ii. Cobweb model for market economy graph from given data.
 $D = 12.4 - 1.2 P, S = 8.0 - 0.6 P_1, D = S, P_0 = 1.0$
2. a) Why Monte Carlo method is used in simulation? Evaluate the value of following integral using Monte Carlo method and also calculate the error percentage. 8
- $$\int_0^1 \frac{4}{1+x^2} dx$$
3. b) Construct analog computer from given equation considering the initial conditions:
 $(d^2x/dt^2) + 0.5 (dx/dt) + x = 4, x(0)=0, (dx/dt)x(0)=1$ 7
4. a) What is CSSLs? Write the structure of CSMPIII. 7
- b) Compute the process for the delay-call system in a simulation of a Telephone system. 8
5. a) What is discrete system? How arrival patterns can be generated for this type of system? 7
- b) What are the two desired properties of random numbers? Describe any two algorithms to generate pseudo random numbers with example. 8
6. a) Write a SIMSCRIPT program for MAIN routine of the telephone system. 7
- b) For discrete system GPSS is used. Write GPSS code for manufacturing shop model with one inspection processed at one time. 8
7. a) Why output analysis is significant in simulation? How is it done in estimation method? 7
- b) How does initial bias make an adverse effect? Discuss about the process of eliminating initial bias effect. 8
8. a) Write short notes on: (Any two) 2×5
 - a) Predator Prey Model
 - b) Stochastic activities
 - c) Chi-square test

POKHARA UNIVERSITY

Level: Bachelor Semester: Fall Year : 2016
 Programme: BE Full Marks: 100
 Course: Simulation and Modeling Pass Marks: 45
 Time : 3hrs.

- a) Uniformity test
- b) Cobweb Model
- c) Digital analog simulator.

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

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Attempt all the questions.

- .. a) Differentiate between continuous and discrete system in detail. What do you mean by verification process? 7
- .. b) Why Monte-Carlo method is best method for computing static model? 8
Derive the value of pi using Monte-Carlo simulation method.
2. a) Why do you think that Time Advancement Mechanism is necessary in simulation study? How can it be implemented in simulation? 7
- b) "When call does not get connect it is not lost but it maintains delayed list and gets automatic connection when line is free." Verify this statement on the basis of various states involved in this simulation. 8
3. a) Explain CSMP-III program. What is feedback system? 5+4
- b) Explain why real time simulation is needed. 6
4. a) How utilization and occupancy are measured in discrete system simulation? Explain with example. 8
- b) What are the two desired properties of pseudo random numbers? 7
Explain any one method to test each property.
5. a) When data are auto-correlated which output analysis method is used? 8
Explain it with reference of SSQM.
- b) Which output analysis method is preferable for random number, 7 explain?
6. a) Explain about facility and storage entity with reference to manufacturing shop. 7
- b) What are the tasks to be performed during simulation programming? Explain with neat diagram. 8
7. Write short notes on: (Any two) 2×5

POKHARA UNIVERSITY

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Semester: Spring

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Attempt all the questions.

1. a) Why simulation is essential in depicting real world problem. 7
Differentiate continuous and discrete system.
- b) Solve $I = \int_0^5 \frac{x^3}{x^4 + 16}$ by Monte Carlo method. Also estimate the error 8 percentage.
2. a) What are steps used in simulation study? Explain with neat block diagram. 7
b) Explain Analog computer. Draw the suitable analog computer model 8 for the following set of differential equations.

$$\begin{aligned} dx_1/dt &= -k_{12}x_1 + k_{21}x_2 \\ dx_2/dt &= -k_{12}x_1 - (k_{21} + k_{23})x_2 \\ dx_3/dt &= k_{23}x_2 \end{aligned}$$
3. a) Why do you think that CSMP III is important in simulation? Explain 7 with reference to CSMP III program of automobile wheel.
- b) What are the various types of calls? Simulate telephone system for 8 lost call system.
4. a) How time can be represented in discrete system? Explain Counters 7 and summary measures.
- b) Use the chi-square test with $\alpha=0.05$ to test whether the data shown 8 below are uniformly distributed. Critical value for $n=10$ is 16.9.

0.34	0.90	0.25	0.89	0.87	0.44	0.12	0.21	0.46	0.67
0.83	0.76	0.79	0.64	0.70	0.81	0.94	0.74	0.22	0.74
0.96	0.99	0.77	0.67	0.56	0.41	0.52	0.73	0.99	0.02
0.47	0.30	0.17	0.82	0.56	0.05	0.45	0.31	0.78	0.05
0.79	0.71	0.23	0.19	0.82	0.93	0.65	0.37	0.39	0.42
0.99	0.17	0.99	0.46	0.05	0.66	0.10	0.42	0.18	0.49
0.37	0.51	0.54	0.01	0.81	0.28	0.69	0.34	0.75	0.49
0.72	0.43	0.56	0.97	0.30	0.94	0.96	0.58	0.73	0.05
0.06	0.39	0.84	0.24	0.40	0.64	0.40	0.19	0.79	0.62
0.18	0.26	0.97	0.88	0.64	0.47	0.60	0.11	0.29	0.78

5. a) Workers come to a supply store at the rate of one every 5 ± 2 minutes. 7 Their requisitions are processed by one of two clerks who take 8 ± 4 minutes for each requisition. The requisitions are then passed to a single storekeeper who fills them one at a time, taking 4 ± 3 minutes for each request. Write a GPSS block diagram to simulate the problem for 1000 requisitions to be filled.
- b) When simulation process is to be repeated, which output analysis 8 method is preferred?
6. a) When data gets biased at the beginning of the analysis it needs to be 5 removed, what are the processes to remove it?
- b) Explain about the organization of SIMSCRIPT program with suitable 5 example.
- c) Explain about independence property of random number. Explain any 5 two methods to test the independence property.
7. Write short notes on: (Any two) 2×5
 - a) Validation and verification
 - b) Single server queuing model
 - c) Recording Distribution

POKHARA UNIVERSITY

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Semester: Fall

Year : 2017

Programme: BE

Full Marks: 100

Course: Simulation and Modeling

Pass Marks: 45

Time : 3hrs.

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Attempt all the questions.

1. a) What is system modelling? How are models verified and validated? Explain. 8
- b) What is an initial bias? What are the different methods to eliminate it? 7
2. a) What is Monte Carlo method? Find the value of π using this method. 8
- b) How is an electric circuit modeled in analog computer? Model the following equations for an analog computer.
$$MX'' + DX' + KX = F(t)$$
 7
3. a) What is CSSL and why were they developed? Explain the structure of CSMP III 7
- b) What is bootstrapping? How are the arrivals of an event are generated and analyzed in discrete system simulation? 8
4. a) Workers come to a supply store at the rate of one every 5±2 minutes. Their requisitions are processed by one of two clerks who takes 8±4 minutes for each requisition. The requisitions are then passed to a single store keeper who fills them one at a time, taking 4±3 minutes for each request. Simulate the queue of workers and measure the distribution of time taken for one thousand requisitions to be filled. Draw a GPSS block diagram and write program for the same. 7
- b) Explain the organization of a SIMSCRIPT program with suitable diagram. 8
5. a) Suppose we have a sequence of 4000, 3 digit number (from 000 to 999) and if we can expect about 400 members in each of the range. The observed value is given as:

Range	No. of observed occurrences
0-99	425
100-199	378
200-299	395
300-399	415
400-499	340
500-599	370
600-699	410
700-799	382
800-899	365
900-999	394

Perform chi-square test for the test of randomness of occurrence at 1% significance level. For $n=10$ classes, $\alpha = 2.09$

- b) The sequence of numbers 0.54, 0.73, 0.97, 0.10, and 0.67 has been generated. Use the Kolmogorov-Smirnov test $\alpha = 0.05$ to determine the hypothesis that the numbers are uniformly distributed on the interval [0,1] can be rejected. (Note that critical value of D for $\alpha = 0.05$ and $n = 5$ is 0.565).
6. a) Discuss about the experimental nature of simulation. How is it different from analytical method.
- b) What are different calls in telephone system? What happens when each type of call occurs? How and when statistics is gathered during these various types of calls?
7. Write short notes on: (Any two)
 - a) Feedback System
 - b) Principle of modeling
 - c) Replication of run

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Attempt all the questions.

1. a) Define Verification and Validation of model. Explain the iterative process of calibrating of a model with example. 8
 - b) What is Monte-Carlo Simulation method? Can this be used as a accuracy method? Use it to derive the value of pi. 7
 2. a) What are the steps involved in computer simulation? Explain with neat diagram. 8
 - b) What is differential equation? How can this be used to represent feedback system? Explain it to simulate a autopilot system. 7
 3. a) List the advantage and disadvantage of analog simulation. Draw the suitable analog computer model for the following set of differential equations. 8
- $$\frac{dx_1}{dt} = -k_{12}x_1 + k_{21}x_2$$
- $$\frac{dx_2}{dt} = -k_{12}x_1 - (k_{21} + k_{23})x_2$$
- $$\frac{dx_3}{dt} = k_{23}x_2$$
- b) Explain telephone call simulation for delayed call system. 7
4. a) What are the major differences between measuring utilization and occupancy? Explain the event oriented time advance mechanism. 8
 - b) Use Runs up and runs down test to determine the following sequence of number can be accepted or rejected on hypothesis of independence where $\alpha=0.05$. 7

0.34	0.90	0.25	0.89	0.87	0.44	0.12	0.21	0.46	0.67
0.83	0.76	0.79	0.64	0.70	0.81	0.94	0.74	0.22	0.74
0.96	0.99	0.77	0.67	0.56	0.41	0.52	0.73	0.99	0.02
0.47	0.30	0.17	0.82	0.56	0.05	0.45	0.31	0.78	0.05
0.79	0.71	0.23	0.19	0.82	0.93	0.65	0.37	0.39	0.42
0.99	0.17	0.99	0.46	0.05	0.66	0.10	0.42	0.18	0.49

5. a) Consider a bank with 3 service counter where customer arrival time is in average of 5, with a variance of 2 minutes. If any customers find the first service counter busy, he/she goes to another service counter but it takes 3 extra minutes to move into the another service counter, similar condition for reaching to third counter. It takes average of 10 minutes to provide service to any customer with 2, 3, 4 minutes' variance respectively at counter 1,2 and 3. Develop GPSS model considering 20% customer do not get proper services. 8
- b) List the advantage of using simulation package over programming language. Explain the types of discrete system simulation language. 7
6. a) Which output analysis method is favorable when the output is interdependent? Explain it with reference of example. 8
- b) If the same process is repeated for multiple runs, which of the analysis method is used and how? 7
7. Write short notes on: (Any two) 2x5
 - a) Distributed Lag Model
 - b) Properties of Random Numbers
 - c) Feedback system

POKHARA UNIVERSITY

Level: Bachelor
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Semester: Fall

Year : 2019
Full Marks: 100
Pass Marks: 45
Time : 3 hrs.

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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. Explain hybrid computers. 8
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: $Z_{0.025}=1.96$]

- b) What are the two desired properties of pseudo random numbers? 7
Generate random numbers using Linear Congruential method with $x_0=27$,

$a=17$, $c=43$ 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.
b) Why do we need analysis of simulation output? Explain the replication of run.
7. Write short notes on: (Any two)
a) Real Time Simulation
b) Elimination of Initial bias
c) Components of queuing system

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Attempt all the questions.*

1. a) What is simulation and modeling? Briefly explain its application. 8
b) Why simulation is considered as "The Last Resort"? 7
2. a) What is system simulation? Discuss with examples why some systems are not appropriate to simulate? 7
3. 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
4. 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
5. a) What is lost call? How can we maintain the calls from being lost? Simulate the telephone system for such calls (Delayed calls). 7
b) Write the algorithm for K-S uniformity test. Use multiplicative congruential method to generate a sequence of four-three-digit random number with seed=117, multiplier=43 and modulus=1000. 8
6. 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. 8
b) How temporary entities, permanent entities and variables can be declared using SIMSCRIPT language. 7
c) When same process is repeated multiple times replication of runs is used to analysis the output. Explain it. 7

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Attempt all the questions.

1. 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
2. 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
3. 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
4. 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 SJMSCRIPT Program. Explain the organization of SIMSCRIPT Program.
- b) There are 48 people in a institute studying programming. They all start writing a program at the same time. It takes each student 15 (+ .) minutes to write the program. Only 35% of the program will run correctly for first time. When program has an 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 one program correctly? Simulate the given program with block diagram and code of GPSS.
6. a) How does initial bias make an adverse effect? Discuss about the process of eliminating initial bias.
- b) What is the method used when the simulation is repeated multiple times?
7. Write short notes on: (Any Two):
 - a) SSQM
 - b) Measuring utilization and occupancy
 - c) Real time simulation

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Simulation and Modeling

Semester: Spring

Year : 2019
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 system environment? Explain with reference to open and close system? 7
1. 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
2. b) What are the steps to be taken in simulation? Explain with neat diagram. 8
3. a) Explain Predator Pray Model with example. 8
3. 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
4. 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
5. 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, 24, 26,
74, 22, 62, 12, 90, 36, 83, 32, 75,
31, 94, 34, 37, 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 replication of run? 7
6. b) Write SIMSCRIPT code for arrival routine of telephone call simulation. 8
7. Write short notes on: (Any two) 2/5
 - a) Feedback System
 - b) Differential Equations
 - c) Measure of queuing system

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2020

Programme: BE

Full Marks: 100

Course: Simulation and Modeling

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.

$$D = 12.4 - 1.2 P, S = 8.0 - 0.6 P, D = S, P_0 = 1.0$$

3. a) What is an analog method? Design an analog computer for human liver. The equations for human liver are 7

$$\frac{dx_1}{dt} = -k_{12}x_1 + k_{21}x_2$$

$$\frac{dx_2}{dt} = k_{12}x_1 - (k_{21} + k_{23})x_2$$

$$\frac{dx_3}{dt} = k_{23}x_2$$

- 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. 7

Use the Kolmogorov-Smirnov Test with $\alpha=0.05$ to determine, if the

hypothesis 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 correlated. (Use $\chi^2_{0.05,7} = 14.067$)

49, 95, 82, 19, 41, 31, 12, 53, 62, 40, 87, 83, 26, 01, 91, 55, 38, 75, 50, 35, 71, 57, 27, 85, 52, 08, 35, 57, 88, 38, 77, 86, 29, 18, 09, 96, 53, 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.

- b) Write a SIMSCRIPT program for MAIN routine of the telephone system

7. Write short notes on: (Any two)

a) Elimination of initial bias.

b) Replication of Run.

c) Differential Equations.

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Simulation and Modeling

Semester: Fall

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

- i) "Before system simulation, it is necessary to predict how a system performs its activities". Explain this with the principles of system modeling. 7
- ii) 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
- iii) Discuss about continuous system Simulation Language (CSSL). Explain different components of analog methods. 8
- iv) 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 $P_0 = 1.0$
- v) 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.
- vi) 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
- vii) 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? Illustrate. 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: 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.

The figures in the margin indicate full marks.

Attempt all the questions.

1. 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
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 3 minutes. There are 3 inspection machines at one place and need 30 to

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

POKHARA UNIVERSITY

Semester: Fall

Level: Bachelor
Programme: BE
Course: Simulation and Modelling

Year : 2022
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? How system can be represented in various model?
Explain with example. 7
- b) Why Monte-Carlo method is best method for computing static model?
Use it to solve $\int_0^3 \sqrt{1+x^3} dx$ using 10 samples. Also estimate the error percentage. 8
2. a) Draw the cobweb model in graph for:
 i) Fluctuation of market price.
 ii) Cobweb model for market economy graph from given data.
 $D=12.4 - 1.2P, S=7.0 - 0.6, P_1, D=S, P_0=1.0$ 8
- b) Differentiate between continuous and discrete system. Design an analog computer for automobile suspension wheel. 7
3. a) What is CSSL and why were they developed? Explain the structure of CSMP III. 8
- b) What are the various types of calls? Simulate telephone system for lost call system. 7
4. a) Why do you think that Time advancement Mechanism is necessary in simulation study? How can it be implemented in simulation? 8
- b) The following numbers have been generated 0.54, 0.73, 0.98, 0.11 and 0.68. Use KS test to check whether given numbers are uniformly distributed or not at 95% confidence interval. 7
5. a) Using chi-square test with $\alpha = 0.05$, Check for the uniformity of the given random no. 8

0.87	0.69	0.12	0.83	0.60	0.95	0.01
0.93	0.27	0.58	0.23	0.99	0.75	0.19
0.28	0.15	0.88	0.36	0.89	0.33	0.68
0.31	0.35	0.49	0.64	0.91	0.05	0.28
0.41	0.43					

- b) Which section is used to declare the variables, entities and routines in SIMSCRIPT language? Declare variables entities and routines of telephone call simulation in the section. 7
6. a) Explain about facility and storage entity with reference to manufacturing shop. 8
- b) How does initial bias make an adverse effect? Discuss about the process of eliminating initial bias effect. 7
7. Write short notes on: (Any two) 2x5
 - a) Utilization and occupancy
 - b) Replication of run
 - c) Predator pray model

POKHARA UNIVERSITY

Semester: Spring

Year : 2023

Full Marks: 100

Pass Marks: 45

Time : 3 hrs.

Level: Bachelor

Programme: BCA

Course: Simulation and Modelling

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.

- a) Define simulation. Explain different types of model. 2+6
- b) What do you mean by Monte Carlo method? Estimate the value of $\int_2^5 x dx$ using Monte Carlo method. (Use 15 samples) 1+6
- c) What are types of system simulation? Explain the steps involved in simulation study. 2+6
- d) What is CSSLS? Write CSMP III code for automobile suspension wheel. 2+5
- e) Draw the analog model of the Liver with following set of equations 8

$$dx_1/dt = -k_{12}x_1 + k_{21}x_2$$

$$dx_3/dt = k_{23}x_2$$

$$dx_2/dt = k_{12}x_1 - (k_{21} + k_{23})x_2$$
- f) Calls are lost when lines are busy or link is not free. Explain various steps involved to simulate this system. 7
- g) How is statistics gathered in simulation? Explain with reference to telephone system. 8
- h) Using Additive Congruential, find the period of the generator and set of random numbers for $a=5$, $c=7$, $m=64$ & seed $X_0 = 5$. 7
- i) Using chi-square test with $\alpha = 0.05$, Check for the uniformity of the given random no. 7

0.89	0.69	0.12	0.83	0.60	0.95	0.01
0.93	0.27	0.58	0.23	0.99	0.75	0.19
0.28	0.15	0.88	0.36	0.89	0.33	0.63
0.31	0.35	0.49	0.64	0.91	0.05	0.27
0.41	0.43					

- b) Patients are arriving at the clinic with the interval time from 6 to 10 minutes. The patients take 3 minute to reach the doctor room. The patient has to wait in a queue if the doctor found to be busy otherwise the doctor takes about 8 to 10 minutes for examining each patient. Draw GPSS block diagram and write a code to simulate for 200 patients check by the 5 doctors. 8

6. a) Explain the SIMSCRIPT execution cycle in details with diagram. 7
- b) Define Estimation method. What are the problems occurred during simulation Run statistic? Explain how it can be maintained? 2+6
7. Write short notes on: (Any two) 2×5
 - a) Time advancement mechanism
 - b) Elimination of initial bias
 - c) Utilization and occupancy

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Simulation and Modeling

Semester: Spring Year : 2023
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) 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

$$I = \int_0^{\pi/2} \sin x \cos x \, dx$$

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, 0.58, 0.61, 0.98, 0.31, 0.90, 0.88, 0.65

5. a) From the below given Random numbers check its uniformity using chi-square method for 95% accuracy.
(Use standard table for appropriate value.) 16
- 194 128 130 179 176 181 138 180 128 134 139 119 160 101 142 145
182 193 186 145 130 150 186 158 104 102 106 148 102 139 160 121
170 100 121 159 132 176 133 183 156 125 173 105 195 137 106 111
193 108 185 134 195 155 124 189 197 158 167 105 130 161 192 131
195 164 107 177 134 178 102 169 112 176 106 157 139 150 193 181
164 136 109 171 155 129 114 118 133 131
- b) 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. 16

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. 7
7. Write short notes on: (Any two) 7
- a) Elimination of initial bias
b) Generation of arrival patterns
c) Queuing System

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Simulation and Modeling

Semester: Fall

Year : 2023
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.

- a) Explain the different components of system with example. Write down the advantages and disadvantages of simulation. 4+4

- b) Estimate the value of $\int_2^5 x^2 dx$ using Monte Carlo method. 7

- c) Cobweb Model can be used as an economic tool for analyzing the dynamics of supply and demand in market. Verify the statement. 7

- d) Illustrate how continuous system simulation can be used to represent real world problems using nonlinear differential equation. 8

- e) What are the advantages and limitations of analog computers compared to digital? Discuss the fundamental components involved in analog computer design and draw analog computer for mechanical system. 7

- f) Use the chi-square test with $\alpha=0.05$ to test whether the data shown below are uniformly distributed. Critical value for $n=10$ is 16.9. 8

0.34	0.90	0.25	0.89	0.87	0.44	0.12	0.21	0.46	0.67
0.83	0.76	0.79	0.64	0.70	0.81	0.94	0.74	0.22	0.74
0.96	0.99	0.77	0.67	0.56	0.41	0.52	0.73	0.99	0.02
0.47	0.30	0.17	0.82	0.56	0.05	0.45	0.31	0.78	0.05
0.79	0.71	0.23	0.19	0.82	0.93	0.65	0.37	0.39	0.42
0.99	0.17	0.99	0.46	0.05	0.66	0.10	0.42	0.18	0.49
0.37	0.51	0.54	0.01	0.81	0.28	0.69	0.34	0.75	0.49
0.72	0.43	0.56	0.97	0.30	0.94	0.96	0.58	0.73	0.05
0.06	0.39	0.84	0.24	0.40	0.64	0.40	0.19	0.79	0.62
0.18	0.26	0.97	0.88	0.64	0.47	0.60	0.11	0.29	0.78

- a) How do you handle lost call in telephone simulation. Explain with necessary figures. 7

- b) What is utilization and occupancy? How are they measured? Explain with examples. 8

- c) Explain the organization of SIMSCRIPT program with suitable diagram. 7

- b) Write GPSS block diagram for manufacturing shop model where there is single inspector and single transaction can be handled at a time. 8
6. a) Discuss the role of replication of runs in analysis of output for simulation and modeling. 8
- b) What kind of outputs are obtained in simulation and modeling? Explain in detail. 7
7. Write short notes on: (Any two) 2x5
- a) Generation of arrival patterns
- b) Real Time Simulation
- c) Single server queuing system