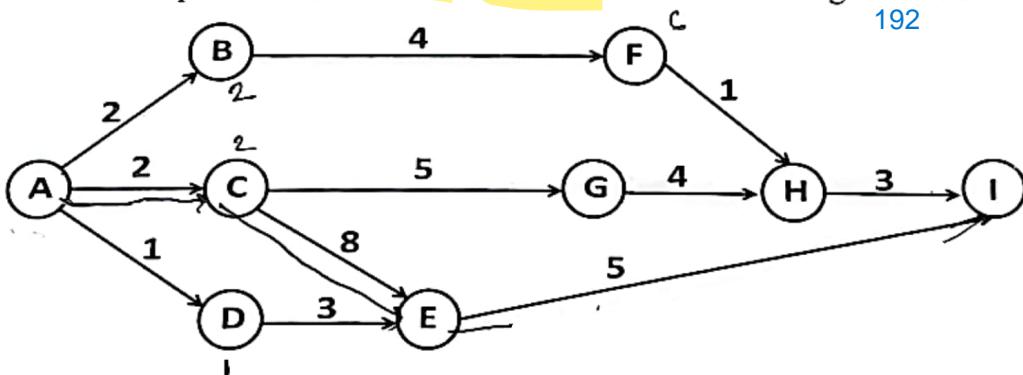




**SECTION A**  
**[ANSWER ANY THREE OF THE FOLLOWINGS]**

- 1.(a) What is simulation? Why simulation is required? 9 [2.00]  
(b) Discuss the situation when simulation is not appropriate tool. 8 [2.00]  
(c) What are the different components of a system? Explain each of them. 18-20 [2.75]  
(d) Why it is necessary to decide on the boundary between a system and its environment? Is it possible to simulate a system without modeling any entity from outside the boundary of the system? Justify your answer with appropriate example.
- 2.(a) What are the properties of random numbers? Mention some uses of random numbers. 102 b-1 116 [2.25]  
(b) What kind of problems may occur when generating pseudo random numbers? 106 [1.50]  
(c) What is linear congruential method (LCM)? Simulate the LCM algorithm for seed=0, multiplier=22, increment=1 and modulus=72. 111 [4.00]  
(d) What is one of the cons of LCM? 114 [1.00]
- 3.(a) Discuss Bernoulli distribution with example. [4.00]  
(b) Define in-degree and out-degree of an activity diagram with necessary figures. [1.75]  
(c) What do you mean by the slack time of an activity with respect to the network model of a project? Which activities don't get any slack time and why? 195  
2-116 [3.00]
- 4.(a) Explain the basic steps in PERT techniques. 205 [4.00]  
(b) Find the critical path and calculate the slack time for the following network. 192 [4.75]



**SECTION B**  
**[ANSWER ANY THREE OF THE FOLLOWINGS]**

- 218                            226
- 5.(a) What is modeling? Compare between physical and mathematical model in brief. [3.00]  
(b) Is there a unique model of every system? Discuss about the tasks of deriving a [3.75]  
model. 222  
(c) What do you know about 'blobby objects'? 272 [2.00]
- b-417
- 6.(a) What is interpolation? Why is interpolation needed? 275 [2.00]  
(b) What is a spline? What are the differences between interpolation and approximation [2.75]  
splines? 273
- (c) Mention some of the cons of polynomial interpolation. qs-4 [2.00]  
(d) What do you mean by Quadratic spline? qs-5 [2.00]
- 7.(a) What is Hermite interpolation? Why do we use Hermite polynomials? qs-6 [2.00]  
(b) Derive the expression for the Hermite blending functions to generate spline curve. [5.00]  
(c) What are the limitations of Hermite curve? qs- 7 , b- 423 [1.75]
- 8.(a) Is Bezier curve an interpolation curve? Why B-spline curve better than Bezier [2.00]  
curve?  
(b) What are the important properties of Bezier curve? *independently fitted with curve* [4.00]  
(c) What are the uses of Bezier curve? What are the limitations of Bezier curve? [2.75]

**University of Rajshahi**  
**Department of Computer Science & Engineering**  
**B.Sc. Engineering Part IV Odd Semester Examination 2020**  
**Course Code: CSE 4131**  
**Course Title: Computer Simulation and Modeling**

**Full Marks: 52.5**

**Time: 3 Hours**

[Answer any SIX (06) questions taking THREE (03) from each section]

**Section A**

1. a) Define entities, attributes and activities of a system with real-world examples. 18-20 3  
 b) How do simulations improve our lives? Compare among live, virtual and constructive simulation. 2.75  
 c) Explain continuous and discrete-event simulation. 3
2. a) Explain the properties of random numbers. 2021 2a 2.75  
 b) What is meant by pseudo random number? Why are they called pseudo? 2  
 c) Explain the Linear Congruential Generators for generating pseudo random number. 4  
 Given, seed( $X_0$ )=27, constant multiplier ( $a$ )=17, increment ( $c$ )=43 and modulus ( $m$ )=100. Generate at least 6 pseudo random number using this information. (Apply Linear Congruential Generators). 2021 2-c
3. a) Discuss about LCM as a pseudo random number generator. 111 1.50  
 b) Why should we perform different types of tests on pseudo random numbers? Name some of such tests. 121 1.25  
 Does the following random sequence properly maintain uniformity and independence property of randomness? Utilize corresponding tests as needed to justify your answer. (Consider,  $0.207 \leq \chi^2 \leq 14.86$  for degree of freedom,  $v = 4$  and 125)  
 the level of significance,  $\alpha = 0.05$  and the corresponding,  $Z_{\alpha/2} = 1.96$   
 (Here, the range of numbers is = [1,99] and the count of numbers = 40)
 

64	48	86	13	9	31	33	74	25	45
98	2	87	31	88	79	78	48	51	51
65	37	49	95	15	36	13	64	42	33
55	18	49	91	8	24	43	53	9	27
4. a) Consider a project having 6 well defined, non-overlapping individual activities named A, B, C, D, E, and F. Draw a network model of the project with respect to following restriction:
  - (i) The project starts with A and B
  - (ii) A must proceed C
  - (iii) B must proceed D and F
  - (iv) D must proceed E and I
  - (v) C and E must proceed G
  - (vi) F must proceed H
  - (vii) The project ends with G, H and I
 b) Find out the critical path (nodes) and the critical activities of the project described by following table using forward pass and backward pass technique. 6.50

## Section -B

5. a) What is modeling? Describe the relationship among verification, validation and calibration of models. 4.00  
2021 5a part-a
- b) Draw and describe the iterative process of calibrating a model. 4.75
6. a) Draw the full corporate model indicating all the internal components of the major segments. 2.75
- b) Discuss about the 2 broad categories of 3D object representation. Which categories do Blender and Minecraft use for 3D object representation? 3.00
- c) Explain the concept of geometric tables with examples. 3.00
7. a) What is a spline? What are the differences between interpolation and approximation splines? 2.50
- b) Explain the parametric continuity conditions with appropriate figures. 1.50
- c) Mention some of the disadvantages of polynomial interpolation. 2021 6-c 2.00
- d) Note down the spline specifications. 2.75
8. Write short notes on (any three) 8.75
- i) Bezier curve
- ii) Chi-square test
- iii) 3D object representation
- iv) Fractal object

Answer six questions taking any three questions from each section

Section-A

1. a) What is simulation? Why simulation is required? 2021 1a 2.25
- b) What is model? Write the classification of different types of models? 25-28 2.00
- c) Construct the mathematical model from the static physical model of an electrical circuit with an inductance L, a resistance R and a capacitance C, connected with a voltage source which varies with time, denoted by the function E(t). The model is meant for the study of the rate of flow of current as E(t) varies with time. 4.50
2. a) What do we use to represent the everchanging nature of real-world systems? Can this attribute be truly virtually imitated? 2.00
- b) How can we test the uniformity of a true random sequence? Consider the following random sequence of 25 numbers, where the range of the values are [0, 9]:  
7, 5, 8, 7, 6, 3, 5, 2, 7, 0, 9, 7, 5, 7, 3, 4, 2, 7, 4, 9, 7, 3, 0, 7, 5 ✓  
 There is a problem with this sequence. Identify and explain the problem using simple tally and/or probability method.
- c) Mention 5 different types of tests for any given random sequence, along with the property of randomness, do each of the test. 1.75
- d) Write down the important considerations of random number generator routines. 2.00
3. a) Let's consider an UFO in a 2D space. Its X and Y coordinates are dependent on the following 2 LCM random number generators of range [0, 99]. Values of (Seed, A, C, M) for each of these LCM random number generators are {X: (71, 33, 21, 100)} and {Y: (63, 51, 29, 100)}. Generate 6 pairs of (X, Y) coordinates for the UFO which would represent {(X<sub>0</sub>, Y<sub>0</sub>), (X<sub>1</sub>, Y<sub>1</sub>), ... ..., (X<sub>4</sub>, Y<sub>4</sub>)}; positions of the UFO from (starting) 0 to (ending) 4 minutes on the 2D space.  
 Again, consider a fighter jet which would have its starting position at {(X<sub>0</sub>, Y<sub>0</sub>): (0, 0)} on the same 2D space. The fighter will try to destroy the UFO, such that it will always move straight towards the UFO at any given minute. Its velocity is 20 units per minute. The fighter will be able to destroy the UFO if the distance between the 2 becomes less than or equal to 25 units. Will the fighter be able to destroy the UFO within 0 to 4 minutes? 4.75
- b) Does the following random sequence properly maintain uniformity and independence property of randomness? Utilize corresponding tests as needed to justify your answer. Here, consider  $0.207 \leq \chi^2 \leq 14.86$  for degree of freedom,  $v = 4$  and level of significance,  $\alpha = 0.05$ ; thus,  $Z_{\alpha/2} \rightarrow Z_{0.025} = 1.96$  4.00

0.62	0.73	0.79	0.81	0.51	0.93	0.83	0.94	0.89	0.66
0.52	0.87	0.89	0.52	0.87	0.77	0.74	0.94	0.81	0.87
0.44	0.32	0.36	0.18	0.07	0.19	0.18	0.26	0.36	0.34
0.31	0.45	0.48	0.43	0.46	0.35	0.25	0.39	0.46	0.41

4. a) What do you mean by an "arrow diagram" to represent an activity in a network model of a project? How events or milestones get represented? Explain with appropriate figures. 3.50
- b) What is slack time of an activity? Which activities don't get any slack time and why? 2021 3c 3.25
- c) Draw an activity network using the information given in the following table: 2.00

Activity No. (k)	Starting Node, S(k)	Finishing Node, F(k)	Time, T(k)
1	1	2	5.1
2	1	3	7.5
3	3	2	6.0
4	3	4	4.5
5	2	5	9.2
6	4	5	8.6

2020

Activity No. (k)	Starting Node, S(k)	Finishing Node, F(k)	Time, T(k)
A	1	2	7.5
B	1	3	8.0
C	2	5	4.5
D	3	4	3.0
E	4	5	5.0
F	3	6	2.0
G	5	7	5.5

## Section B

5. a) Explain the underlying concepts of boundary-representation and space-partitioning as 3D object representation systems. 4.50  
 b) Note down the differences between 2-D models and 3-D models with examples. 2.25  
 c) What are the advantages of CAD? 2
6. a) What is a voxel? How is it related to space-partitioning 3D object representation system? 1.75  
 b) What is Blender? What kind of 3D object representation system does it use? 2020 6b 1.75  
 c) What are the advantages of wireframe modeling? 2.25  
 d) Discuss about constructive solid-geometry method of modeling with an example. 3
7. a) Explain the principles used in modeling with appropriate diagrams. 3.75  
 b) Describe the business-infrastructure of a manufacturing industry following the concepts of the corporate model. 5
8. a) Explain the parametric continuity conditions applicable for piecewise construction of a curve. 2020 7b 2.75  
 b) What is the difference between spine and spline? 1.50  
 c) List the differences between Bezier curve and B-Spline curve. 2021 8a 4.50

2019

University of Rajshahi  
Department of Computer Science and Engineering  
B.Sc. (Engg.) Part-4, Odd Semester, Examination-2018  
Course: CSE4131 (Computer Simulation and Modeling)  
Marks: 52.5 Time: 3:00 Hours

[N.B. Answer any Six questions taking Three from each section]

Section – A

1. a) Which types of simulation are implemented in the applications of "Augmented Reality" and "Virtual Reality"? Justify your answer with examples. 3  
b) What does a system represent? What are the components of it? Explain with examples. 3  
c) Why is it necessary to decide on the boundary between a system and its environment? 1.25  
d) Is it possible to simulate a system without modeling any entity from outside the boundary of the system? Justify your answer with an appropriate example. 1.5  
2021 1-d
  
2. a) Define pseudo random number. Why is it named 'pseudo'? 2020 2b 2  
b) What are the statistical properties of random numbers? 2021 2a 2  
c) Write an algorithm to generate random numbers using linear congruential method. Hence, simulate the algorithm for seed=5, multiplier=3, increment=3 and modulus=7. 3  
d) What kind of problems may occur when generating pseudo random numbers? 1.75
  
3. a) Discuss about LCM as a pseudo random number generator. What are its strengths and weaknesses? 2020 3-a 3  
b) Why should we perform different types of tests on pseudo random numbers? Name some of such tests. 1.25  
c) Mention the differences between "Runs Up-Down" and "Runs Above-Below" tests for pseudo random numbers. Perform these 2 tests on the following sequence of pseudo random numbers and decide upon whether the sequence displays the property of independence of randomness. 4.5  
(Consider the level of significance,  $\alpha = 0.05$  and the corresponding,  $Z_{\alpha/2} = 1.96$ )  
(Here, the range of numbers is = [1, 50] and the count of numbers = 30)  

22	21	41	31	13	15	45	26	29	5
4	20	48	25	34	14	44	41	2	47
1	33	40	7	18	37	24	32	35	10
  
4. a) How do activities and their precedence relationship get represented in a network model of a project? Explain with appropriate figures. 2.5  
b) Discuss about the concept of a dummy activity. Why is it needed? 1.5  
c) Can there be multiple critical paths in a single project? If so, can the CPM method find all the critical paths of a project via only one cycle of both forward and backward pass? Explain with example. 4.75

## Section – B

5. a) Suppose that in a simulation, the decision-making systems of human are being modeled against some specific situations. What type of model is being used here? Why? Justify your answer. 3
- b) Discuss about space-partitioning as a 3D object representation system with a real-world example. What are the weaknesses of this system? 3
- c) What do you know about the concepts of geometric tables? Explain with an appropriate example. 2.75
6. a) Discuss about the different parametric continuity conditions with appropriate examples. 3
- b) Which models can be classified as corporate models? Briefly discuss about the internal components of the management segment of any corporate model. 3.75
- c) According to the principle of modeling, a balance should be achieved via 1st block building and finally aggregation. Why and how? Justify your answer. 2
7. a) Define self-similar, statistically self-similar, self-affine fractals with examples. 3
- b) The similarity of a self-similar fractal is described by its dimension, show that  $D = \frac{\ln(n)}{\ln(1/s)}$ , where D is the fractal dimension, n is the number of sub parts and s is the scaling factors. 2.75
- c) Explain the random midpoint displacement method for constructing fractal objects. 3
8. a) Discuss about the additional parameters introduced by Kochanek-Bartels splines to provide for further flexibility in adjusting the shape of curve sections. 4.5
- b) Note the distinct features of a b-spline curve when compared to a Bezier curve. 3
- c) How does CSG method work for solid modeling? Explain with an appropriate example. 1.25

# University of Rajshahi

Department of Computer Science and Engineering

B. Sc. Engg. Part-4, Odd Semester, Examination 2017

Course: CSE 4131 (Computer Simulation and Modelling)

Marks: 52.5

Time: 3 Hours

(Answer any three questions from each part)

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Dept. of Computer Science & Engineering  
University of Rajshahi

## Part-A

1. a) Compare live, virtual and constructive simulation with examples. 3  
b) Discuss the situations when simulation is not an appropriate tool. 2021 1-b 1.75  
c) Note down the steps of simulation study with appropriate flowchart. 4
- must ✓
2. a) What are the properties of random numbers? Mention some uses of random numbers 2021 2-a 2.75  
b) Discuss the similarities and dissimilarities between random number and pseudo random number. 3  
c) Which points should be considered while designing a pseudo random number generator? Explain why? 3
3. a) Explain discrete random variables and continuous random variables. 2  
b) Write down the names of different approaches of runs test. Define "run" with respect to runs test of pseudo random numbers. 2.75  
c) Show that the following sequence of numbers may pass the  $\chi^2$  test (perform the  $\chi^2$  test too, to prove so), but still unable to be called a good random sequence: 4  
0.08 0.09 0.23 0.29 0.42 0.55 0.58 0.72 0.89 0.91  
0.11 0.16 0.18 0.31 0.41 0.53 0.71 0.73 0.74 0.84  
0.02 0.09 0.30 0.32 0.45 0.47 0.69 0.74 0.91 0.95  
0.12 0.13 0.29 0.36 0.38 0.54 0.68 0.86 0.88 0.91
4. a) Discuss Bernoulli distribution with example. 2021 3 4.75  
b) Define in-degree and out-degree of an activity diagram with necessary figures. 1  
c) What do you mean by the slack time of an activity with respect to the network model of a project? Which activities don't get any slack time and why? 3

## Part-B

- slide 5. a) What is modeling? What are the differences between physical modeling and mathematical modeling? 3  
b) Is there a unique model of every system? Discuss about the tasks of deriving a model. 2.75  
c) Discuss in detail the principals used in modeling. 3
- slide 2. a) What is fractal object? 2  
b) Discuss different types of fractal objects. 3.75  
c) How the dimension of a fractal object may be defined? Explain. 3
- a) What is meant by spline curve and why are cubic splines used frequently in computer graphics? 2.75  
b) What are the properties of Bezier curve? 3  
c) Discuss the major segments of a Corporate Model with diagram. 3