National University of Computer and Emerging Sciences

Lahore Campus

Simulation and Modeling (CS 4056)

Sessional-I Exam Review Assignment

Date: Sep 22 2025

Course Instructor(s)

Dr. Mirza Mubasher Baig

Total Time (Hrs): **Due Before Exam**

Total Marks: **5%**

Total Questions:

Instructions: Answer in the space provided. Attach extra sheets if needed

CLO 1: **Demonstrate** basic understanding of Probabilistic Models and their use in Simulation.

Question 1: PART A [Statistical Models in Simulation]

Part a)

i) What is a random variable?

ii) Provide an example of a discrete random variable defined on the population of individuals using the university cafeteria services.

iii) Assuming the discrete random variable from the previous part follows a uniform distribution, specify its probability mass function (PMF)

iv) Provide an example of a continuous random variable defined on the population of individuals using the university cafeteria services.

v) Assuming the continuous random variable from the previous is exponential with $\lambda = 5$, compute the PDF of this random variable.

vi) Using uniform random numbers between 0 and 1 and the PDF computed in previous part, find a formula to generate random number that follow the distribution of this random variable.

vii) Using your formula from previous part generate the random numbers corresponding to the following three uniformly generated random numbers 0.1, 0.9, 0.5

viii) Find the PDF of a continuous random variable X that is uniformly distributed between 2 and 5

ix) Use your PDF from the previous part to compute $P(3 < X < 4.3)$

x) Plot the PDF of a Bernoulli random variable with $p = 0.2$

xi) Plot the PDF of a Binomial random variable with $n = 3$ and $p = 0.2$

xii) What is a geometric random variable? Write the expression of probability mass function of a geometric random variable.

xiii) Read about the Poisson random variable and give a formula for the PMF of a Poisson random variable with parameter α

xiv) Derive a formula to generate uniform random numbers from the interval [a, b] using uniform random numbers distributed between 0 and 1.

xv) What is the density function of an exponential random variable with parameter λ?

xvi) Derive expression for the PDF of exponential random variable of the previous part.

xvii) Solve the following questions from Chapter 6 Exercise. {1, 3, 5, 24}

xviii) Solve the following questions from Chapter 7 Exercise. {4 generate only three random numbers starting with a seed of your choice, 6, 10}

xix) Using the PDF given in exercise 5 of chapter 8 derive an expression for generating random numbers with this distribution by using uniform random numbers between 0 and 1

xx) Solve exercise 9 of chapter 8. You must do it without an explicit inverse calculation. Use the value of the function at different values to find the mapping