



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI-ABUJA**  
**FACULTY OF COMPUTING**  
**DEPARTMENT OF COMPUTER SCIENCE**  
**2025\_2 EXAMINATIONS**

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**Course Code:** CIT412

**Course Title:** Modelling & Simulation

**Course Credit:** 3 units

**Time Allowed:** 3 hours

**Instruction:** Answer **Question One (1)** and any other **Three (3)** Questions

**Question 1: 25 marks (Compulsory)**

- 1 (a) List and briefly explain three measures of central tendency. (6 marks)
- 1 (b) What is the range of a dataset? Calculate the range for the following set of numbers: 4, 1, 4, 3, 2. (3 marks)
- 1 (c) Explain how to convert a normal distribution to a standard normal distribution. Why is this conversion useful? (6 marks)
- 1 (d) Describe the relationship between probability and the normal curve. How is the total area under the curve related to probability? (5 marks)
- 1 (e) A researcher is studying the heights of adult males in a population. The mean height is 175 cm with a standard deviation of 7 cm. Assuming heights are normally distributed, what proportion of males are taller than 182 cm? Show your calculations. (5 marks)

**Question 2: 15 marks**

- 1 (f) Define Monte Carlo methods and explain their primary purpose in computational algorithms. (3 marks)
- 1 (g) Describe the general algorithm used in Monte Carlo methods, outlining the four main steps. (6 marks)
- 1 (h) Explain how Monte Carlo methods can be used to approximate the value of  $\pi$ , providing a step-by-step description of the process. (7 marks)

**Question 3: 15 Marks**

- 3 (a) What is a normal distribution? Describe its key characteristics. (5 marks)
- 3 (b) Explain how skewness is measured in distributions. What is Pearson's first and second coefficients of skewness? (6 marks)
- 3 (c) A national achievement test has a mean score of 850 with a standard deviation of 100. If a student scores 940, calculate their z-score and interpret what this means in terms of their performance relative to other students. (4 marks)

**Question 4: 15 Marks**

- 4 (a) Define probability and explain the difference between the frequentist and Bayesian interpretations of probability. (4 marks)
- 4 (b) Describe the key properties of a probability function  $p(x)$  or  $f(x)$  for continuous variables. (5 marks)
- 4 (c) Explain the concept of a random variable and distinguish between discrete and continuous random variables. Provide an example of each. (6 marks)

**Question 5: 15 Marks**

- 5 (a) Define simulation and explain its underlying purpose. (3 marks)
- 5 (b) Describe three objectives of simulation studies. (6 marks)
- 5 (c) Explain when simulation should be used, providing two specific examples. (6 marks)

**Questions 6: 15 marks**

- 6 (a) Define a queuing model and explain its purpose in queuing theory. (3 marks)
- 6 (b) List and briefly describe five performance measures that can be determined using queuing models. (5 marks)
- 6 (c) Outline the general procedure for constructing and analysing queuing models. (7 marks)