

BOWEN UNIVERSITY, IWO
COLLEGE OF COMPUTING AND COMMUNICATION STUDIES
COMPUTER SCIENCE PROGRAMME
B.Sc. DEGREE SECOND SEMESTER EXAMINATION 2022/2023 SESSION FOR
WEEKEND PROGRAMME
COURSE CODE: CIT 436 COURSE TITLE: INTRODCUTION TO COMPUTER
MODELLING AND SIMULATION
COURSE CREDIT: 3 DATE: DURATION: 2½ HOURS
INSTRUCTION: ATTEMPT ANY FOUR QUESTIONS

Question 1

- a. List the methods of generating pseudorandom numbers. (3marks)
- b. i. State the formula for the Linear Congruential Method. (2marks)
ii. Use $r_0 = 27$, $k = 17$, $a = 43$, and $m = 100$, find r_1 to r_5 . (10marks)
- c. Let $N(t)$ be a Poisson process with rate $\lambda = 5/\text{min}$. Find the probability that exactly 2 events occur by $t = 3$ (10marks)

Question 2

The time until a bus arrives to a stop is exponential with mean 10 minutes. The time until a taxi arrives is exponential with a mean of 5 minutes.

- a. What is the probability of waiting at least 5 minutes for a bus or taxi? (17marks)
- b. What is the probability that a taxi comes first? (4marks)
- c. What is the probability a bus arrives first? (4marks)

Question 3

- a. How would you define a queue? (2marks)
- b. With what parameter would you measure the performance of a queue? (3marks)
- c. List the characteristics of a queue system (6marks)
- d. A secondary school has 6 grades (1st grade through 6th grade). Every year, 60 new students enroll in first grade. The students' progress through the successive grades and leave upon completing 6th grade. What is the total number of students enrolled at the school? (7marks)
- e. The owner of a shop observes that on average 20 customers per hour arrive and there are typically 5 customers in the shop. What is the average length of time each customer spends in the shop? (7marks)

Question 4

- a. i. Differentiate between a Bernoulli trial and a Binomial experiment. (2 marks)
ii. Give five examples of continuous distribution. (4 marks)
- b. A laboratory network consisting of 20 computers was attacked by a computer virus. This virus enters each computer with probability 0.4, independently of other computers.
 - i. Find the probability that the virus enters at least 2 computers. (6 marks)

- ii. A computer manager checks the lab computers, one after another, to see if they were infected by the virus. What is the probability that she has to test 6 computers before he finds one infected with virus? **(7marks)**
- c. Suppose that the number of inquiries arriving at a certain interactive system follows a Poisson distribution with arrival rate of 12 inquiries per minute. Find the probability of 10 inquiries arriving in a 1-minute interval. **(6marks)**

Question 5

- a. i. Differentiate between descriptive statistics and inferential statistics. **(4marks)**
 ii. What is a random variable? State the types of random variable you are aware of. **(4marks)**
- b. Entry to a certain university is determined by a national test. The scores on this test are normally distributed with a mean of 500 and a standard deviation of 100. Kemi wants to be admitted to this university and she knows that she must score better than at least 90% of the students who took the test. Kemi takes the test and scores 585. Will she be admitted to this university? **(5marks)**
- c. The annual salaries of employees in a large company are approximately normally distributed with a mean of ₦50,000 and a standard deviation of ₦ 20,000.
 - i. What percent of people earn less than ₦ 40,000? **(3marks)**
 - ii. What percent of people earn between ₦ 45,000 and ₦ 65,000? **(6marks)**
 - iii. What percent of people earn more than ₦ 70,000? **(3marks)**

Question 6

- a. What features will you look for, in a problem that will make using simulation modelling and analysis suitable for its solution? **(6marks)**
- b. What is modelling? **(5marks)**
- c. How would you convince a friend of yours who is indifferent to using simulation modelling for the solution of a problem in spite of the fact that this approach can be effectively used to solve the problem? **(10marks)**
- d. How would you discourage your friend from modelling with a general purpose language? **(4marks)**