



NATIONAL OPEN UNIVERSITY OF NIGERIA
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja
Faculty of Science
2024 1 EXAMINATION

DEPARTMENT: COMPUTER SCIENCE
COURSE TITLE: MODELING AND SIMULATION
COURSE CODE: CIT412
CREDIT UNIT(S): 3
INSTRUCTION(S): ATTEMPT FOUR (4) QUESTIONS IN ALL, QUESTION ONE (1) IS COMPULSORY
TIME: 3 HOURS

QUESTION ONE

- A. The management Fidelity Investment Corporation wants to study the investment projects based on the factors, namely, market demand in units price per unit minus cost per unit, and investment required. These factors are believed to be independent of each other. In analyzing a new consumer product, the Corporation estimates the following probability distribution:

| Annual Demand | | Price minus Cost per Unit | | Investment Required | |
|---------------|-------------|---------------------------|-------------|---------------------|-------------|
| Units | probability | ₦s | probability | ₦s (Millions) | Probability |
| 20,000 | 0.2 | 3.00 | 0.10 | 1.750 | 0.25 |
| 25,000 | 0.10 | 5.00 | 0.20 | 2.00 | 0.50 |
| 30,000 | 0.20 | 7.00 | 0.40 | 2.50 | 0.25 |
| 35,000 | 0.30 | 9.00 | 0.20 | | |
| 40,000 | 0.20 | 10.00 | 0.10 | | |
| 45,000 | 0.10 | | | | |
| 50,000 | 0.05 | | | | |

Considering the following sequence of thirty random numbers: 28, 19, 18, 57, 07, 61, 60, 90, 16, 17, 02, 71, 64, 57, 43, 20, 28, 68, 27, 29, 47, 58, 83, 24, 61, 58, 19, 30, 41, 97. Using the simulation process, repeat the 10 times, compute the return on investment for each trial taking the three factors into consideration. What is the most likely return? Note: Return = ((Price-Cost)* Number of units demanded)/ Investment (14½ marks)

- B. State the importance of Modeling? (2 marks)
C. Using the mid square method, write a procedure for generating pseudo random number? (3½ marks)
D. Consider an LCG with parameters ($m = 8$, $a = 5$, $c = 1$, $R_0 = 5$). Compute the first nine values for R_i and U_i from the defined sequence? (5 marks)

QUESTION TWO

- A. What is random number and state properties of a good random number generator? (7 marks)
B. Develop a function procedure called RAND in QBASIC which generates a random number between 0 and 1 using the mixed congruential method. Assume a 16-bit computer? (4 marks)
C. List other methods of generating Random Numbers? (4 marks)

QUESTION THREE

- A. Give some examples of real-world applications where modeling and simulation have been used successfully (5 marks)
- B. Customer calls arrive at a software support center with exponentially distributed inter arrival times with an average time between arrivals of 15 minutes. What is the probability that 5 customers will arrive between 1 and 2:30 p.m.? (5 marks)
- C. Explain the following simulation terminologies: i. Event ii. State iii. Scheduling
iv. Queue v. Creating (5 marks)

QUESTION FOUR

- A. Itemize five (5) factors important in evaluating a model (5 marks)
- B. Briefly discuss the application of stochastic process in three fields (6 marks)
- C. Write a QBASIC program to simulate the result of 10 calls made by a salesman, given that each call has 50% chance of success and 50% chance of failure? (4 marks)

QUESTION FIVE

- A. What is an Outlier and state any two (2) ways to handle outlier? (4 marks)
- B. List two (2) advantages and two (2) disadvantages of mixed methods (4 marks)
- C. What is data coding and why do data coding (7 marks)

QUESTION SIX

- A. What is Queueing model? (1 mark)
- B. Itemize five state performance measures to be determined for a queueing model? (5 marks)
- C. Discuss the six (6) general procedures for constructing and analyzing queueing model (9 marks)

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