NATIONAL OPEN UNIVERSITY OF NIGERIA
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja
Faculty of Science
2024_2 EXAMINATION

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

QUESTION ONE

A. The management of Primack Company is considering marketing a new product. The fixed cost required in the project is ₦4,000. Three factors are uncertain, viz, the selling price, variable cost and the annual sales volume. The product has a life of only one year. The management has the data on these three factors as under:

Selling Price	probability	Variable Cost	probability	Sales Volume	Probability
3	0.2	1	0.3	2,000	0.3
4	0.5	2	0.6	3,000	0.3
5	0.3	3	0.1	5,000	0.4

Considering the following sequence of thirty random numbers: 81, 32, 60, 04, 46, 31, 67, 25, 24, 10, 40, 02, 39, 68, 08, 59, 66, 90, 12, 64, 79, 31, 86, 68, 82, 89, 25, 11, 98, 16. Using the sequence (First 3 random numbers for the first trial, etc.) simulate the average profit for the above project on the basis of 10 trials (12 marks)

B. A plant has a large number of similar machines. The machine breakdown or failure is random and independent. The manager in-charge of the plant collected the data about the various machines breakdown time, the repair time required on hourly basis, and the record for the past 100 observation. This is shown below was:

Time between recorded Machine Breakdowns (hours)	Probability	Repair Time Required (Hours)	Probability
0.5	0.05	1	0.28
1	0.06	2	0.52
1.5	0.16	3	0.20
2	0.33		
2.5	0.21		
3	0.19		

Considering the following sequence of thirty random numbers: 61, 87, 85, 39, 16, 28, 46, 97, 88, 69, 08, 87, 82, 52, 56, 52, 22, 15, 49, 85, 44, 41, 33, 82, 77, 98, 87, 99, 54, 23. For each hour that one machine is down due to being, or waiting to be, repaired, the plant loses $70 by way of lost production. A repairman is paid at $20 per hour. (13 marks)

QUESTION TWO

Arrivals at a cyber café, which has only one PC, follows a Poisson process with a rate 9 minutes. The service time is exponentially distributed with a mean of 3 minutes. If the queueing discipline is FCFS, determine the following:

A. The probability that an arriving customer will not wait before using the PC. (3 marks)
B. The average queue length formed from time to time. (6 marks)
C. The owner of the cyber café will buy a second PC when convinced that an arriving customer will wait for more than 4 minutes Find the increase in the flow of arrivals which will justify buying a second PC (6 marks)

QUESTION THREE

A. What is a seed? (3 marks)
B. Explain how you can generate random numbers using a seed? (7 marks)
C. Describe the Kendall notation for queues (5 marks)

QUESTION FOUR

A. Discuss not less than three (3) point the difference between Descriptive statistics and Inferential statistics? (6 marks)
B. What is Univariate analysis? (1 mark)
C. Name and explain the three (3) characteristics of Univariate analysis? (8 marks)

QUESTION FIVE

A. Distinguish the statisticians three levels of modeling assumption? (6 marks)
B. Discuss Poisson process with respect to it five (5) essential feature? (7½ marks)
C. Give any three (3) example of Poisson process? (1½ marks)

QUESTION SIX

A. Mention two (2) mode of inference and give three (3) example of Poisson process? (3 marks)
B. List two (2) key factors of Cochran's (1977) Formula? (4 marks)
C. List four (4) ways of Cochran (1977) to estimating population variances for sample size determinations? (8 marks)