



**NATIONAL OPEN UNIVERSITY OF NIGERIA
FACULTY OF SCIENCE
DEPARTMENT OF COMPUTER SCIENCE
2020_1 EXAMINATION**

COURSE CODE: CIT 412
COURSE TITLE: MODELLING AND SIMULATION
CREDIT: 3 UNITS
TIME ALLOWED: 3 HOURS
INSTRUCTION: Answer question 1 and any four (4) others

- 1a) Identify the difference between alpha and beta error in survey designs *(2 marks)*
- b) Describe four (4) ways in which an outlier can be properly handled *(4 marks)*
- c) Examine when data codes are determined for questionnaires and interviews *(2 marks)*
- d) Define the trajectory of a random walk *(2 marks)*
- e) Differentiate between discrete-event and continuous event simulation language *(3 marks)*
- f) Distinguish between homogenous and non-homogenous Poisson process *(4 marks)*
- g) (i) List the three files used by SIMNET II to keep track of transactions *(3 marks)*
 (ii) Explain what a placebo in an experiment signify *(2 marks)*

- 2a) The table below shows an experiment where a doctor is studying the possible effects of two different creams on people skin condition to see which combination is most effective.
- (i) List the independent variables manipulated by the doctor *(2 marks)*
 - (ii) How many levels has CARO TONE factor. List them *(3 marks)*

		CARO TONE			
		0 mg	15 mg	20 mg	25 mg
CARO WHITE	0 mg	Neutral	Light	Ebony	Melanin
	30 mg	Caramel	Fair	Ivory	Tan brown
	50 mg	Coffee Brown	Olive	Black brown	Dark

- b) Explain two (2) characteristics of a well-designed experiment *(3 marks)*
 - c) If 2 dice are tossed, estimate the probability of getting a 9 as sum of the outcome? *(4 marks)*
- 3a) A computer repair shop has one machine and 12 waiting jobs, in addition to the job that is currently being processed. The processing time is exponentially distributed with mean 25 minutes.
- (i) Devise a SIMNET II statement for this problem *(2 marks)*
 - (ii) With explanation, illustrate a graphical network representing this situation *(4 marks)*
- b) Identify the importance of probability theory to performance modeling of information systems *(3 marks)*
 - c) Compare two approaches to model development *(3 marks)*
- 4a) (i) When is a stochastic process said to be a Brownian motion process *(2 marks)*
 (ii) List three (3) applications of stochastic processes *(3 marks)*

- b) In a packet switched network, packets travel from the LAN through a router to the WAN. The packet length is assumed exponentially distributed with average of 128 bytes, the average arrival rate of packets is 7 per second and the transmission time of the router is 9600 bps. Determine the system's stability (3 marks)
- c) Using question 4(b) above,
(i) Compute the average residence time in the router (2 marks)
(iii) Compute the average number of packets in the router (2 marks)
- 5a) Given a congruential generator, $X_{i+1} = (aX_i + c)(\text{mod } m)$, where $a = 3$, $X_0 = 5$, $c = 3$, $m = 7$
(i) Generate 10 random sequence of integer numbers (5 marks)
(ii) Determine the period of the set of numbers (1 marks)
- b) Outline three (3) advantages of using models (3 marks)
- c) Distinguish between descriptive and inferential statistics (3 marks)
- 6a) (i) Distinguish between a queuing system and a queuing model (3 marks)
(ii) List three (3) performance measures that can be determined by a queuing model (3 marks)
- b) Describe the operations of a single server queuing model (2 marks)
- c) From this set of data 5, 9, 2, 4, 5, 11, estimate Pearson's first coefficient of skewness (4 marks)