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, $X_{i+1} = (aX_i + c)(mod\ m)$, where $a = 3,\ X_o = 5, c = 3,\ m = 7$

    (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)*