UNIVERSITY EXAMINATIONS

EXAMINATION FOR SEPTEMBER/DECEMBER 2019/2020 FOR BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BACHELOR OF BUSINESS INFORMATION TECHNOLOGY

RCS 106: PROBABILITY AND STATISTICS

DATE: 19TH DECEMBER 2019 **TIME: 2 HOURS**

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination paper during examination time.

This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

This examination paper consists Questions in Section A followed by section B.

Answer **Question 1 and any Other Two** questions.

QUESTIONS in ALL Sections should be answered in answer booklet(s).

1. **PLEASE start the answer to EACH question on a NEW PAGE.**
2. **Keep your phone(s) switched off at the front of the examination room.**
3. **Keep ALL bags and caps at the front of the examination room and DO NOT refer to ANY unauthorized material before or during the course of the examination.**
4. **ALWAYS show your working.**
5. **Marks indicated in parenthesis i.e. ( ) will be awarded for clear and logical answers.**
6. **Write your REGISTRATION No. clearly on the answer booklet(s).**
7. **For the Questions, write the number of the question on the answer booklet(s) in the order you answered them.**
8. **DO NOT use your PHONE as a CALCULATOR.**
9. **YOU are ONLY ALLOWED to leave the exam room 30minutes to the end of the Exam.**
10. **DO NOT write on the QUESTION PAPER. Use the back of your BOOKLET for any calculations or rough work.**

SECTION A (COMPULSORY)

QUESTION 1 (30 MARKS)

a). (i)Define the term parameter. **[1 Marks]**

(ii).Thirty automobiles were tested for fuel efficiency, in miles per gallon (mpg). The following frequency distribution was obtained. Construct a histogram, a frequency polygon, and an ogive for the data.

Class	8-12	13-17	18-22	23-27	28-32	32-36
Frequency	3	5	15	5	2	13

[5 Marks]

b). A volunteer ambulance service handles 0 to 5 service calls on any given day. the probability distribution for the numbers of service calls is as follows;

Numbers of service calls x	0	1	2	3	4	5
Probability $P(X = x)$	0.10	0.15	0.30	0.20	0.15	0.10

i). What is the expected number of service calls? **[2 Marks]**

c). Briefly explain the difference between skewness and kurtosis. Hence illustrate graphically the three type's skewness and the three types of kurtosis. ` **[5 Marks]**

d) .The heights (in feet above sea level) of the major active volcanoes in Alaska are given here. Construct a grouped frequency distribution for the data.
4,265 3,545 4,025 7,050 11,413 3,490 5,370 4,885 5,030 6,830 4,450 5,775 3,945 7,545 8,450 3,995 10,140 6,050 10,265 6,965 150 8,185 7,295 2,015 5,055 5,315 2,945 6,720 3,465 1,980 2,560 4,450 2,759 9,430 7,985 7,540 3,540 11,070 **[6 Marks]**

d). The following table shows the frequency distribution of the diameter of 50 bottles (length has been measured to the nearest millimeter). Obtain

Class	Frequency
35-39	6
40-44	12
45-49	15
50-54	10
55-59	7

i). The first and third quartiles. **[4 Marks]**

ii). The semi-inter quartile range. **[2 Marks]**

e). If there are 500 customers per eight-hour day in a check-out lane, what is the probability that there will be exactly 3 in line during any five-minute period? **[5 Marks]**

SECTION B (ANSWER ANY TWO QUESTIONS)

QUESTION 2 (20 MARKS)

a). Starting at 5 pm every half hour there is a flight from Nairobi to Mombasa. Suppose that none of these plane tickets are completely sold out and they always have room for passages. A person who wants to fly to Mombasa arrives at the airport at a random time between 8.45 AM and (.45 AM. Determine the probability that he waits for

i). At most 10 minutes **[3 Marks]**

ii). At least 15 minutes **[2 Marks]**

iii). What is At least 15 minutes **[2 Marks]**

b). A patient is given a drip feed containing a particular chemical and its concentration in his blood is measured, in suitable units, at one hour intervals. The doctors believe that a linear relationship will exist between the variables.

Annual advertising budget	0	1	2	3	4	5	6	7
Yearly profit increase	2.4	4.3	5	6.9	9.1	11.4	13.5	15.6

i). Determine the line of best fir for this data and interpret your values. **[11 Marks]**

ii). Given that $Y = 5$ find the value of X. **[2 Marks]**

QUESTION 3 (20 MARKS)

a). The actual tracking weight of a stereo cartridge that is set to track at 3 grams on a particular changer can be regarded as a continuous random variable with the density

$$f(x) = \begin{cases} k(1-(x-3)^2) & 2 \le x \le 4 \\ 0 & elsewhere \end{cases}$$

i). Find the value of the constant k. **[4 Marks]**

ii). What is the probability that the actual tracking weight is greater the prescribed weight? **[3 Marks]**

iii). Determine the mean of the distribution. **[3 Marks]**

b). The weight change after participating in the Slim Possible Challenge for women were measured in kg's as follows:

Weight	No. of Women
20-<30	15
30-<40	1
40-<50	4
50-<60	25
70-<80	9
80-<90	4
90-<100	3
100-<110	4

(To four decimal places where applicable)

i). Find the median **[4 Marks]**

ii). Find the mode. **[3 Marks]**

iii). Estimate the 74. 1^{th} percentile. **[3 Marks]**

QUESTION 4 (20 MARKS)

a). Scores in an examination are assumed to be normally distributed with mean of 78 and a variance of 36.

i). What is the probability that a person taking the examination scores higher than 72? **[3 Marks]**

ii). Supposed that students scoring in the top 10 % of this distribution are to be awarded a grade A. what is the maximum score that a student must score to achieve the grade A? **[3 Marks]**

iii). What must be the cut-off points for the examination if the examiner wants only top 28.1 % of all scores to be passing? **[3 Marks]**

iv). Find, approximately, what proportion of students have scores 5 or more points above the score that cuts off the lowest 25 % **[4 Marks]**

b). The table below gives data relating to percentages of lectures attended by a student in a semester and the corresponding marks for each student in the final exam for that subject.

X= Lectures attendance (%)	70	59	85	93	78	85	84	69	70	82
Y=Exam Results (%)	80	62	89	98	84	91	83	72	75	85

Calculate the Pearson's Product moment correlation coefficient and interpret it.

[7 Marks]

QUESTION 5 (20 MARKS)

a). The following data was availed to you from a statistical investigation.
31, 35, 29, 36, 25, 29, 48, 46, 28, 47, 42

i). Determine the mean and standard deviation of these observations. **[1 Mark]**

ii). Find the coefficient of variation. **[1 Mark]**

iii). Determine the moment coefficient of skewness and interpret your results. **[5 Marks]**

b). The number of stories in two selected samples of tall buildings in a certain first world cities is as shown below.

Atlanta

55	70	44	36	40	63	40	44	34	38
60	47	52	32	32	50	53	32	28	31
52	32	34	32	30	26	29			

Philadelphia

61	40	38	32	30	58	40	40	25	30	50
38	36	54	40	36	30	30	53	39	36	34
33	39	32								

Construct a back to back stem and leaf display for comparing the distributions **[5 Marks]**

c). A student is likely to wake up on time with probability ¾. If he wakes up on time, there is a probability of 9/10 that he will arrive in the dinning hall in time for breakfast. If he oversleeps, there is a probability of ½ that he will arrive at the dining hall in time for breakfast. If he is late in arriving at the dinning hall, there is a probability of 2/3 that he will miss breakfast, but on any occasion he arrives at the dinning hall on time, he has breakfast.

i). Summarize the above information using a tree diagram. **[2 Marks]**

ii). What is the probability that on any one day, he will miss breakfast? **[2 Marks]**

iii). If he misses breakfast, what is the probability that he woke up late? **[2 Marks]**

iv). If the student arrives late for breakfast one day, what is the probability that he woke up late? **[2 Marks]**