SAS 1201 Probability & Statistics I

Actuarial science (Jomo Kenyatta University of Agriculture and Technology)

DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

University Examinations 2020/2021

FIRST YEAR SECOND SEMESTER SPECIAL/ SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF BACHELOR OF **ACTUARIAL SCIENCE.**

SAS 1201': Probability & Statistics I

DATE: 30th NOV 2021 TIME: 11:00 AM - 1:00 PM

Instructions: Answer QUESTION ONE and any other TWO QUESTIONS.

QUESTION ONE (30 Marks) (COMPULSORY)

a). Giving an example in each case, differentiate the following terms as used in statistics:-

i). Nominal and Ordinal data **[2 Marks]**

ii). Continous and Discrete data **[2 Marks]**

iii). Population and Sample **[2 Marks]**

b). Determine the first four moments about the point A=25 of the following distribution. **[5 Marks]**

Class	1 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Frequency	10	25	40	10	5	2

c). The following are scores obtained by students in a Statistics exam. $43, 47, 51, 48, 52, 50, 46, 49, 45, 52, 46, 51, 44, 50, 49, 46, 51, 49, 45, 44, 50, 48, 49, 50$. Construct a box plot of the data and use it to comment on the skewness of the distribution. **[5 Marks]**

d). Two samples 1 and 2 of CAT scores are taken from students in a Mathematics clas. The samples of sizes 40 and 30 respectively, have equal mean but different variances. The variance of sample 1 is 381 while that of sample 2 is 64. Find the standard deviation of the combined group. **[4 Marks]**

e). A student is likely to wake up on time with probability $^3/_4$. If he wakes up on time, there is a probability of $^9/_{10}$ that he will arrive in the dining hall in time for breakfast. If he oversleeps, there is a probability of $^1/_2$ that he will arrive at the dining hall in time for breakfast. if he is late in arriving at the dining hall there is a probability of $^2/_3$ that he will miss breakfast, but on occasion he arrives at the dining hall on time ha has brekfast. What is the probability that on any day he will miss breakfast?

[3 Marks]

f). In a five day week, the probability that a student will be late for a class x days is given by $c\,(5-x)$ where c is a constant. The punishment for being late x days in a week is $3x$ hours of detention in the school. What is the standard deviation of the number of hours a student is detained in a week? **[7 Marks]**

QUESTION TWO (20 Marks) (Optional)

The table below shows the marks obtained by 100 students in a statistics exam.

Marks	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
No. of Students	x	8	12	22	48	y

The average mark for the class in the examination was 46.3.
Determine:

i). The values of x and y. **[4 Marks]**

ii). What was the score of the middle 50 % of the students? **[4 Marks]**

iii). The mark obtained by the highest number of students. **[2 Marks]**

iv). Standard deviation of the distribution. **[2 Marks]**

v). On the same graph, draw a histogram and a frequency polygon for these data.

[4 Marks]

vi). Estimate $P_{10} - P_{90}$ **[4 Marks]**

QUESTION THREE (20 Marks) (Optional)

a). A student plays a game in which a fair six-sided die is tossed once. If the score is 1, 2, or 4, he loses KES 10. She wins x if the score is 3 or 5 and wins $2x$ if the score is 6.

i). Find the probability distribution or returns for this game. **[2 Marks]**

ii). Find the mean and the standard deviation of returns when x =8 **[4 Marks]**

b). Among 1,000 applicants for admission to MSC. Analytics course at DeKUT, 600 were statistics graduates and 400 were non-statistics graduates, 30 % of statistics graduate applicants and 5 % non-statistics graduate applicants obtained admission. If an applicant selected at random is found to have been given admission, what is the probability that he or she is a statistics graduate? **[3 Marks]**

c). A computer system has two components, defined as:

A $\Rightarrow$ First component is good
B $\Rightarrow$ Second component is good

Given that $P(A) = \frac{4}{5}$, $P(B|A) = \frac{17}{20}$ and $P(B|A^c) = \frac{3}{4}$.
Determine the probability that,

i). The second component is good. **[3 Marks]**

ii). At least one of the components is good. **[3 Marks]**

iii). Are A and B independent or mutually exclussive? Verify your answer. **[5 Marks]**

QUESTION FOUR (20 Marks) (Optional)

a). The weekly expenditure of a female student in a college is KES. 720 while that of a male couterpart is KES. 320. If the average spending of a student is KES. 550, find the ratio of male to female students in the college. **[4 Marks]**

b). Three machines A, B and C produces 50%, 30% and 20% of items in a factory. The % defective items from eachof the machines are 3%, 4% and 5% respectively. If an item is chosen at random and is found to be defective, what is the probability that it was produced by machine B? **[3 Marks]**

c). The distribuiton of marks obtained by students in an exam are as follows;

Marks	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
Frequency	4	6	9	5	4	2

i). Using an assumed mean of 34.5, estimate the first four moments about the mean. **[9 Marks]**

ii). Investigate the skewness and peakedness of the distribution of marks. **[4 Marks]**

QUESTION FIVE (20 Marks) (Optional)

a). Distinguish between correlation analysis and regression analysis. **[2 Marks]**

b). A medium firm negotiates an annual pay increase with each of its 12 employees. in order to simplify the process, it is proposed that each employee be given a score x based on one's resposibilities. The annual salary y will be KES (a + bx) and the annual negotiations will only involve the values a and b.The following table gives last year's salaries which were generally accepted as fair and the proposed scores.

Employee	Score	Annual Salary
A	10	5,750
B	55	17,300
C	46	14,750
D	27	8,200
E	17	6,350
F	12	6,150
G	85	18,800
H	64	14,850
I	36	9,900
J	40	1,000
K	30	9,150
L	37	10,400

i). Plot a scatter diagram. **[3 Marks]**

ii). Using a calculater or otherwise, find the regression line y on x. Give the product moment correration coefficient. **[4 Marks]**

iii). Draw the regression line y on x on the scatter diagram. **[2 Marks]**

iv). Comment on whether the suggested method is likely to prove reasonably satisfactory in practice. **[2 Marks]**

v). Without recalculating regression line y on x, find the values of a and b if every employee were to receive a 4% rise plus KES 300 per year. **[2 Marks]**

c). An assesment under competence based curiculum (C.B.C) was conducted on ten children to determine how a child's ability in number work varied with his ability in handicrafts. The marks were awarded as follows:

Child	1	2	3	4	5	6	7	8	9	10
Numeracy	5	9	6	2	0	4	8	7	10	1
Craft	5	6	7	3	4	1	8	10	9	2

Calculate the Spearman's rank correlation coefficient. State what it indicates about the relationship between numeracy and craft. **[5 Marks]**