



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

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AUGUST - DECEMBER 2018 TRIMESTER

FACULTY OF COMMERCE

DEPARTMENT OF ACCOUNTING AND FINANCE

REGULAR PROGRAMME

CMS 311: BUSINESS STATISTICS

Date: DECEMBER 2018

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

- Q1. a) Define and/or make a distinction between the following inferential statistical concepts:
- (i) A statistic versus a parameter. **(2 marks)**
 - (ii) A random variable **(2 marks)**
 - (iii) The probability distribution of a random variable, x . **(2 marks)**
 - (IV) A discrete versus a continuous probability distribution. Name one useful discrete probability distribution and one useful continuous probability distribution that is used in inferential statistical analysis. **(4 marks)**

- b) Motor Case Insurance Company Ltd has obtained the following data relating to the number of cars written off per a thousand cars of a given age:

Age of car (Yrs)	0	1	2	3	4	5	6	7	8	9	10
Number written off	0	45	261	525	748	880	912	944	966	981	1,000

Required:

- (i) Create the probability distribution of x , the number of cars written off. **(3 marks)**
- (ii) What is the probability that a randomly selected car will be written off before it is 6 years old? **(3 marks)**

- (iii) Compute the probability that a randomly selected car is aged 3 years and will be written off before it is 6 years. **(3 marks)**
 - (iv) Compute the population mean number of cars written off for the distribution using an expected value formula. **(3 marks)**
 - (v) Compute the standard deviation of the distribution using an expected value formula. **(4 marks)**
- c) A number of inferential statistical techniques are based on the concept of *sampling* as a necessary toll for learning something about a population of study. Outline at least FOUR reasons why sampling is necessary in research and/or statistical analysis **(4 marks)**

Q2. In each of the following situations identify and use either the binomial, poisson, or normal distribution statistical formulas, depending on which you deem most appropriate:

- a) The lifetime of a certain type of electrical component follow a distribution whose with given statistical parameters of a population mean of 800 hours and a population standard deviation of 160 hours.

Required:

- (i) If the manufacturer replaces all the elements that fail before the guaranteed minimum lifetime of 600 hours, what is the probability that that the components would have to be replaced? **(3 marks)**
 - (ii) If the manufacturer wishes to replace only 1% of the components that have the shortest life, what value should he use as the guaranteed lifetime? **(4 marks)**
 - (iii) What is the probability that the mean lifetime of a sample of 25 of these electrical components exceeds 550 hours? **(4 marks)**
- b) Green Grocer buys peaches in a large consignment directly from a wholesaler. In view of the perishable nature of the commodity, the proprietor Green Grocer accepts that 10% of the supplied peaches will usually be unusable. Given that all the peaches cannot be checked individually, a single batch of 10 peaches is selected on which Green Grocer's proprietor basis her decision on whether to purchase or not. If no more than two of these peaches are unsatisfactory, the Green Grocer purchases the consignment.

Required:

- (i) Determine the probability that under normal supply conditions the consignment will be purchased. **(3 marks)**
- (ii) The proprietor of Green Grocer has informed the wholesaler that if than 50% of the peaches she samples are unsatisfactory, she will no

longer buy from this particular wholesaler. What is the probability the wholesaler will keep the Green Grocer as a customer? **(3 marks)**

- c) Vehicles pass a certain point on a busy single lane road at an average of 2 per 10 second interval.

Required:

Determine the probability that more than three cars pass this point during a 20 second interval. **(3 marks)**

- Q3. a) Suppose that a sample of $n = 50$ items is drawn from a population of manufactured products and the weight, x , of each item is recorded. Prior experience has shown that the weight has a probability distribution with $\mu = 6$ grams and $\sigma = 2.5$ grams. According to the central limit theorem, the sample mean (\bar{x}) will approximately be normally distributed.

Required:

Calculate $\mu_{\bar{x}}$ (the population mean of the sample means) and $\sigma_{\bar{x}}$ (the population standard deviation of the sample means) **(4 marks)**

- b) Tim manufactures farm equipment in Naivasha. His work requires the use of steel bars which must have a mean length of at least 50 inches. The bars can be purchased from a supplier in Nakuru town whose bars average only 47 inches, with a standard deviation of 12 inches, or from a supplier in the City of Nairobi, whose bars average 49 inches, with a standard deviation of 3.6 inches. If Tim was to buy 81 bars, should he use the supplier from Nakuru town or the one from the City of Nairobi, given that he wishes to purchase from the supplier who is more likely to provide him with bars of the required mean length of 50 inches? (In other words, which supplier is more likely to provide Jim with bars with a mean length of 50 inches on the purchase of a sample of 81 bars?).
NB. Hint: Support your answer by calculating the probability or likelihood of a sample (n) of 81 bars providing a mean length (\bar{x}) of at least 50 inches given the population mean (μ) of 47 inches and population standard deviation (σ) of 12 inches for the Nakuru supplier, and comparing with your computed probability of a sample of $n = 81$ bars providing a mean length of at least 50 inches given $\mu = 49$ inches and $\sigma = 3.6$ for the Nairobi supplier. **(7 marks)**

- c) (i) The image of a Japanese manager is that of a workaholic with little or no leisure time. In a survey, a random sample of 250 Japanese middle managers were asked how many hours per week they spent on leisure activities (e.g sports, movies, television). The results of the survey were recorded. The sample mean was 1.5 hours.

Required:

Assuming that the population standard deviation is 6 hours, estimate with 90% confidence the mean leisure time per week for the population of Japanese middle managers. Does the results support the view of a Japanese manager being a workaholic with little or no leisure time? Explain. **(5 marks)**

- (ii) What sample size would be required to estimate the population mean leisure time per week to within 30 minutes with 90% confidence? **(4 marks)**

- Q4. a) Make a distinction between the following statistical terms that are associated with the concept of hypothesis testing:
- (i) A hypothesis statement versus hypothesis testing. **(2 marks)**
 - (ii) The null hypothesis (H_0) versus alternate hypothesis (H_1) **(2 marks)**
 - (iii) Level of significance versus test-statistic. **(2 marks)**
 - (iv) One-tailed test versus two-tailed test **(2 marks)**
 - (v) Type I error versus Type II error. **(2 marks)**
- b) A new gym, Weight Reducers International, claims and advertises that those who join will lose, on the average, at least 10 kgs for the first six months with a population standard deviation of 2.8 kgs. A random sample of 50 people who joined the new gym revealed the mean loss to be 9 kgs after 6 months. At the 0.05 level of significance, can we conclude that those joining Weight Reducer's on average will lose less than 10 kgs? How justified is Weight Reducer's claim? Carry out an appropriate test of hypothesis utilizing the five-step hypothesis-testing procedure to answer this question. **(10 marks)**

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