TECHNICAL UNIVERSITY OF MOMBASA

Applied sciences

Mathematics & Physic department

UNIVERSITY EXAMINATION FOR: BACHLOR OF SCIENCE IN MARINE RESOURCE (BSMR

Type program name

AMA 4320: BIOSTATISTICS.

END OF SEMESTER EXAMINATION

SERIES: Sect seriesPickyear

TIME: Choose hoursHOURS

DATE: Pick DateSelect MonthPick Year

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of Five questions. Attempt question one (compulsory) and any other two questions.
Do not write on the question paper.

Question ONE (30 mks)

(a) Define the following :   (5mks)
  i.   Type I error
  ii.   Random variable
  iii.   Hypothesis
  iv.   Observational study
  v.   Skewness

(b) An engineer is interested in testing the "bias" in a pH meter. Data are collected on the meter by measuring the pH of a neutral substance (pH = 7.0). A sample of size 10 is taken, with results given by:

7.07, 7.00, 7.10, 6.97, 7.00, 7.03, 7.01, 7.01, 6.98, 7.08.

Find
  i.   Sample mean   (2 mks)
  ii.   Sample median   (3 mks)
  iii.   Sample Range   (2 mks)
  iv.   Sample standard deviation   (4 mks)

(c) A large industrial firm purchases several new word processors at the end of each year, the exact number depending on the frequency of repairs in the previous year. Suppose that the number of word processors, X, purchased each year has the following probability distribution:

x	0	1	2	3
P(X=x)	1/10	3/10	2/5	1/5

(i) Show that, the distribution is a pmf (1 mk)
(ii) Find the mean of X (2 mks)
(iii) Find the standard deviation of X (3 mks)

(d) The contents of seven similar containers of sulphuric acid are
9.8, 10.2, 10.4, 9.8, 10.0, 10.2, and 9.6 litres.

Find:
(i) The sample Mean (2 mks)
(ii) The sample variance (3 mks)
(iii) The 95% confidence interval for the mean contents of all such containers, assuming an approximately normal distribution (3 mks)

Question TWO (20 mks)

(a) A study was made of some popular fast-food items. In particular, a regression analysis was done for predicting calorie content from the amount of fat in a food item. Some regression output from Mintab is given below:

Regression Analysis: Calories versus Fat

The regression equation is
Calories = 242 + 7.35 Fat

Predictor	Coef	SE Coef	T	P
Constant	242.03	68.44	3.54	0.003

Fat	7.353	2.860	2.57	0.021

$$S = 152.030 \quad R\text{-}Sq = 29.2\% \quad R\text{-}Sq(adj) = 24.8\%$$

    i.   What is the value of the slope of this regression line?   (1 mk)
    ii.   Which is the best interpretation of the slope of this regression line?   (2 mks)
    iii.   Predict the calorie content of an item containing 15 units of fat.   (3 mks)

b) Water flowing across farmland washes away soil. Researchers released water across a test area at different flow rates and measured how much soil was washed away (amount of eroded soil). In this case, which is the explanatory variable and which is the response? (3 mks)

c) Past experience indicates that the time required for high school seniors to complete a standardized test is a normal random variable with a mean of 35 minutes. If a random sample of 20 high school seniors took an average of 33.1 minutes to complete this test with a standard deviation of 4.3 minutes, test the hypothesis, at the 0.05 level of significance, that $\mu = 35$ minutes against the alternative that $\mu < 35$ minutes.   (11 mks)

Question THREE (20 mks)

(a) An auto mobile manufacturer is concerned about a fault in the braking mechanism of a particular model. The fault can, on rare occasions, cause a catastrophe at high speed. The distribution of the number of cars per year that will experience the catastrophe is a Poisson random variable with $\lambda = 5$.

    i.   What is the probability that at most 3 cars per year will experience a catastrophe? (3 mks)
    ii.   What is the probability that more than 1 car per year will experience a catastrophe? (2 mks)
    iii.   What is the probability exactly 2 cars per two year will experience a catastrophe? (3 mks)

(b) For a particular group of adult males, the distribution of cholesterol readings is normal with mean 210 and SD 15. Using Normal distribution tables, Find the following, showing your calculation in each case:
    i.   The proportion of males in this group with cholesterol reading less than 240. (3 mks)
    ii.   The proportion of males in this group with cholesterol readings between 200 and 240. (3 mks)
    iii.   The cholesterol reading that 20% of males in this group are higher than (3 mks)

iv.   The first quartile of cholesterol readings for males in this group (3 mks)

Question FOUR (20 mks)

To find out whether a new serum will arrest leukemia, 9 mice, all with an advanced stage of the disease, are selected. Five mice receive the treatment and 4 do not. Survival times, in years, from the time the experiment commenced are as follows:

Treatment: 2.1   5.3   1.4   4.6   0.9

No Treatment: 1.9   0.5   2.8   3.1

  i.   Find the sample mean for each group   (4 mks)
 ii.   Find the sample variance for each group   (6 mks)
iii.   At the 0.05 level of significance, can the serum be said to be effective? Assume the two populations to be normally distributed with equal variances.   (10 mks)

Question FIVE (20 mks)

(a) According to a study published by a group of University of Massachusetts sociologists, approximately 60% of the Valium users in the state of Massachusetts first took Valium for psychological problems. Find the probability that among the next 8 users from this state who are interviewed,

(i) exactly 3 began taking Valium for psychological problems;   (3 mks)
(ii) at least 7 began taking Valium for problems that were not psychological.   (3 mks)

(b) Consider the data below

Class	0 – 9	10 – 19	20 – 29	30 – 39	40 - 49
Frequency	18	20	30	22	10

i.   Find the median   (4 mks)
ii. Find the mean   (3 mks)
iii. Find the range   (3 mks)
iv. Find the standard deviation   (5 mks)