



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF ENVIRONMENT AND HEALTH SCIENCES

UNIVERSITY EXAMINATION FOR:

MASTER OF PUBLIC HEALTH

APH 5109: MEDICAL STATISTICS AND COMPUTING

SPECIAL/ SUPPLIMENTARY EXAMINATIONS

SERIES: SEPTEMBER 2018

TIME: 3HOURS

DATE: Pick Date Sep 2018

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **SIX** Question(s). Attempt any **FOUR** questions.

Do not write on the question paper.

Question ONE

a) Given the sample data below;

23, 45, 57, 34, 355, 147, 782, 26, 29, 30, 1209, 32, 37, 80, 102, 210

Compute the

- i) Interquartile range (IQR) for the data (3 marks)
- ii) standard error for the mean (4 marks)

b) In a test of the null hypothesis $H_0: \mu = 10$ against the alternative hypothesis $H_a: \mu > 10$, a sample from a normal population produced a mean of 13.4. The z-score for the sample was 2.12 and the p-value was 0.007.

Based on these statistics, show how a conclusion can be drawn. (4 marks)

c) The data below was obtained in a count of CD4 cells from 10 AIDS patients:

CD4 count	30	40	35	34	25	29	28	26	28	27
Viral load	80	120	90	100	60	80	70	70	80	70

- i) Write the regression equation for determining viral load from CD₄ counts (7 marks)
- ii) Attach 95% confidence limits to the regression equation (3 marks)
- d) A multiple regression technique was used to analyze a certain set of data and the following result was obtained.
- $$y = 3x_1 + 4x_2 + 1.5x_3 + 15x_4 + 5$$
- (i) State the number of variables involved and state the variable which had the largest influence to the result of the finding? (2 marks)
- (ii) Write research hypothesis that lead to the above results (2 marks)

Question TWO

- a) 40 children aged at least 1 year but under 5 years were chosen for a test of concentrations of copper (in ml) in urine. The following were found.
 0.70, 0.45, 0.72, 0.30, 1.16, 0.69, 0.83, 0.74, 1.24, 0.77,
 0.65, 0.76, 0.42, 0.94, 0.36, 0.98, 0.64, 0.90, 0.63, 0.55,
 0.78, 0.10, 0.52, 0.42, 0.58, 0.62, 1.12, 0.86, 0.74, 1.04,
 0.65, 0.66, 0.81, 0.48, 0.85, 0.75, 0.73, 0.50, 0.34, 0.88
- Determine
- i) the coefficient of variation in the copper levels among the children (4 marks)
- ii) the standard error for estimating the mean copper concentration (3 marks)
- b) A random sample of 50 old men at Muji wa Wazee in Tudor had a mean age of 85 years with a standard deviation of 5.5 years. Construct a 99% Confidence Interval for the age of the old men. (3 marks)
- c) The death rate from a particular form of cancer is 23% during the first year. When treated with an experimental drug, only 15 out of 84 patients die during the initial year. Determine whether there is this strong evidence to claim that the new medication reduces the mortality rate? (3 marks)
- d) A school nurse routinely tests all new children aged 14-16 years for Strabismus (crossed eyes). The prevalence of this condition in this age group is about 5%. The nurse's examination has a sensitivity and specificity of detecting 90%. Those who test positive for the condition are referred to an ophthalmologist whose examination also has a sensitivity and specificity of 90%. If 2000 children are examined by the school nurse;
- i) How many children will be referred to the ophthalmologist? (3 marks)
- ii) How many children will be identified by the ophthalmologist? (3 marks)
- (e) An outbreak of *Pediculus capitis* is being investigated in a girls' school containing 291 students. It was established that 18 out 130 girls who lived in a nearby housing estate were infested and 37 of 161 who live elsewhere were infested. Using the χ^2 test at 95% confidence interval, determine if there is a significant difference in infestation rates for the girls living in the two places (6 marks).

Question THREE

- a) In a campaign against smallpox, a doctor inquired into the number of times 150 people aged above 16 years in a Garissa village had been vaccinated. He obtained the following figures:

Vaccination	Never	once	twice	three times	four times	five times
No. of people	12	24	42	38	30	4

Determine

- i) the mean number of times the people had been vaccinated (3 marks)
 - ii) the standard error for estimating the number times of vaccination (4 marks)
- b) The level of a hormone from a sample of 12 rats was seen to have a mean of 16 ppm. Assuming normal distribution with a variance of 36, determine whether this hormonal level for population is different from a mean of 30 ppm (4 marks)
- c) A general practitioner reviewed all patient notes in four practices for 1 year. Newly diagnosed cases of asthma were noted, and whether or not the case was referred to hospital. The following referrals were found:

	Practice A	Practice B	Practice C	Practice D
No. of referrals	14	11	39	31
Total cases	103	92	166	221

Using the χ^2 test at 95% confidence level, determine whether there are significant differences in the number of referrals in these practices (6 marks)

- d) A new treatment for varicose ulcer is compared with a standard treatment on ten matched pairs of patients, where treatment between pairs is decided using random numbers. The outcome is the number of days from start of treatment to healing of ulcer. One doctor is responsible for treatment and a second doctor assesses healing without knowing which treatment each patient had. The following treatment times were recorded.

Patient no.	1	2	3	4	5	6	7	8	9	10
Standard treatment	35	104	27	53	72	64	97	121	86	41
New treatment	27	52	46	33	37	82	51	92	68	62

- i) Determine the mean difference in the healing time (2 marks),
- ii) Using the t - test at 95% confidence interval, determine if there are statistically significant differences between the treatments (6 marks)

Question FOUR

- a) The process of producing painkiller tablets yields varying amounts of the active ingredient (a.i). It is claimed that the average amount of a.i per tablet is at least 200mg. The Kenya Bureau of Standards (KeBS) tests a random sample of 70 tablets and find a mean a.i. of 194.3 and a standard deviation of 21g.
Determine if this painkiller is within the KeBS standards (5 marks)
- b) A study was conducted to determine the effectiveness of varying amounts of vitamin C in reducing the number of common colds. A survey of 450 people provided the following information:

Observation	Daily amount of vitamin C taken		
	None	500 mg	1000 mg
No colds	57	26	17
At least one cold	223	84	43

- Using an appropriate test at 95% confidence, determine whether there evidence of a relationship between catching a cold and taking vitamin C? (6 marks)
- c) A herbalist has developed a new treatment which he claims to prevent halitosis. 100 halitosis sufferers were divided randomly into two groups; 50 patients received the new treatment and 50 patients received a placebo. At the end of the four weeks trial period they were examined by a dentist to see if they had halitosis. If 30 patients who received the new treatment got well and 30 patients who received the placebo did not get well, determine, at 95% significant level, if there was a significant difference between the treatment and placebo (7 marks).
- d) A dermatologist tested a new topical application for the treatment of psoriasis on 47 patients. He applied it to the lesions on one part of the patient's body and the best traditional remedy to the lesions on another but on a comparable part of the body, the choice of area being made by the toss of a coin. In three patients both areas of psoriasis responded; in 28 patients the disease responded to the traditional remedy but hardly or not at all to the new one; in 13 it responded to the new one but hardly or not at all to the traditional remedy; and in 4 cases neither remedy caused an appreciable response.
Determine, at 99% significance level, whether there were significant differences in the remedies. (7 marks)

Question FIVE

- a) The WHO average for number of WBC in a normal person is given as 50. A researcher has 25 samples and finds the mean is 43.5 with a standard deviation of 2.5.
Using the t-test at 5% significance level, test whether the observations are within the acceptable levels (4 marks)
- b) The following levels of haemoglobin were found in two wards for elderly women in a geriatric hospital:
Ward A: 12.2, 11.1, 14.0, 11.3, 10.8, 12.5, 12.2, 11.9, 13.6, 12.7, 13.4, 13.7 g/dl;
Ward B: 11.9, 10.7, 12.3, 13.9, 11.1, 11.2, 13.3, 11.4, 12.0, 11.1 g/dl.

Using the appropriate test at 95% confidence interval, determine if the difference between the mean haemoglobin levels in the two wards were significant? (6 marks)

- c) The following table shows how two dentists categorized patients into those having bad halitosis and those who did not.

		Dentist 2		
		Halitosis	Healthy	Total
Dentist 1	Halitosis	15	12	27
	Healthy	8	65	73
	Total	23	77	100

Using an appropriate test, at 95% confidence level, test whether there were significant differences in the diagnosis (6 marks)

- d) An independent testing laboratory is asked to compare the (elasticity) of four different brands of condoms. The experimental set up was such that 8 condoms from each manufacturer was randomly selected. The information below was obtained;

	Brands			
	A	B	C	D
Elasticity	20.5	24.2	23.7	21.2
	22.9	25.3	25.9	24.4
	23.8	22.6	26.5	22.9
	21.4	21.9	22.9	27.2
	24.2	25.1	21.8	25.5
	22.5	21.2	26.2	23.3
	20.9	22.4	24.2	22.4
	20.4	24.7	23.4	24.5

Determine if there are significant differences between the elasticity in the four brands of condoms (9 marks)

Question SIX

- a) In one group of 62 patients the iron deficiency anaemia for the haemoglobin level was 12.2 g/dl with a standard deviation of 1.8 g/dl. In another group of 35 patients it was 10.9 g/dl with a standard deviation of 2.1 g/dl.
- Establish whether the standard error of the difference between the two means was significant (4 marks)
 - If the mean haemoglobin level in the general population is taken as 14.4 g/dl, determine if there is a significant difference between the mean of the first sample and the population mean (4 marks)
- b) An agency is interested in estimating family expenditure on medical services based on family income and family size in Kwale County. Fifteen (15) families were randomly selected. The data below was obtained

Family Income (Y) in Thousands of KeS	Family Income (X ₁) in Thousands of KeS	Family Size (X ₂)
0.43	2.1	3
0.31	1.1	4
0.32	0.9	5
0.46	1.6	4
1.25	6.2	4
0.44	2.3	3
0.52	1.8	6
0.29	1.0	5
1.29	8.9	3
0.35	2.4	2
0.35	1.2	4
0.78	4.7	3
0.43	3.5	2
0.47	2.9	3
0.38	1.4	4

- i) Fit all linear regression models involving X₁ and/or X₂ and interpret the estimated regression coefficients (4 marks)
- ii) Compute and interpret the multiple correlation coefficient, R² (7 marks)
- c) A research was conducted to determine the acceptability of two family planning practices in Mombasa County. Twelve randomly selected women were recruited and asked to rate their acceptance of the practice on a scale of 1-5 (where 1 = strongly dislike, 5 = strongly like). The following results were obtained;
Practice A: 1, 2, 5, 5, 4, 3, 5, 4, 4, 3, 5, 2
Practice B: 2, 2, 1, 1, 3, 1, 2, 4, 3, 1, 1, 3
- Using the Mann-Whitney U test at 95% confidence level, determine whether the sample of women represent the views of the women population in Mombasa County (6 marks)