MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

FOURTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF ECONOMICS AND STATISTICS

BACHELOR OF ECONOMICS

EES 405: NON-PARAMETRIC AND SEMI PARAMETRIC STATISTICS

DATE: 21/1/2021 **TIME: 2.00-4.00 PM**

INSTRUCTIONS:

(i) **Answer question one (Compulsory) and any other two questions**

(ii) **Do not write on the question paper**

(iii) **Show your working clearly**

(iv) **Where α has not been provided, use 5%**

(v) **$H_{critical}$=5.991**

QUESTION ONE (COMPULSORY) (30 MARKS)

a) State any two main assumptions of non-parametric tests (2 marks)

b) Discuss the main differences between parametric and non-parametric tests (10 marks)

c) Using examples, highlight the two decision errors that can arise in non-parametric tests (4 marks)

d) Ten candidates sat for two aptitude tests A and B, and the results were as follows.

Candidate											
Test A											
Test B											

By clearly stating the null and alternative hypothesis, test at 5% level of significance whether or not the results correlated. (10 marks)

e) Using appropriate figure, highlight the difference between directional and non-directional hypothesis. (4 marks)

QUESTION TWO 20 MARKS)

a) Outliers are likely to distort the correlation coefficient. State and illustrate using a figure, one method of detecting outliers (2 marks)

b) The following are math scores for form four students in one of the secondary schools in Machakos County.

68 72 65 75 61 82 54

52 66 68 79 88 80 77

38 9 69 66 91 96

Using a sign test, test the null hypothesis M=65 against alternative hypothesis M>65 at the 0.025 level of significance (10 marks)

c) Differentiate between the most powerful and uniformly most powerful test (4 marks)

d) Clearly explain situations when spearman's rank correlation coefficient is applied (2 marks)

e) Why Wilcoxon rank test statistic is considered as powerful as the ordinary sign test? (2 marks)

QUESTION THREE (20 MARKS)

Researchers claim that the low levels of chemicals serotonin in the brain can be one of the triggers for migraines in human. One of the ways serotonin is raised is by taking selective serotonin reuptake inhibitors (SSRIs) type of medication. Nine patients suffering from migraines had their serotonin levels (in manograms per millimeter, ng/ML) measured before taking a SSRIs type of medication and after taking this medication. The results are as shown in table below

Patient	1	2	3	4	5	6	7	8	9
Before	95	86	78	100	98	80	82	78	87
After	178	154	188	210	145	255	95	280	167

Use appropriate non-parametric test to determine if median serotonin levels had significantly increased after taking SSRIs. Use 5% level of significance (10 marks)

a) Discuss variables that the power of a test depends on (8 marks)

b) Explain the major difference between semi parametric tests and parametric tests. (2 marks)

QUESTION FOUR (20 MARKS)

a) Suppose you are given the following data of different samples obtained from three different departments. Test if they are equally distributed. (8 marks)

Sample 1	**Sample 2**	**Sample 3**
8.2	10.2	13.5
10.3	9.1	8.4
9.1	13.9	9.6
12.6	14.5	13.8
11.4	9.1	17.4
13.2	16.4	15.3

b) Explain the following concepts as applied in non-parametric and semi parametric statistics;

i. Non-parametric Test (2 marks)

ii. P-value (2 marks)

iii. Order Statistic (2 marks)

c) The following are measurements of the breaking strength of a certain kind of 2-inch cotton ribbon in pounds:

163 165 160 189 161 171 158 151 169 162

163 139 172 165 148 166 172 163 187 173

Use the sign test to test the null hypothesis M=160 against the alternative hypothesis M>160 at the 0.025 level of significance (6 marks)

QUESTION FIVE (20 MARKS)

a) The effect of concentration of Phenol of the growth of bacteria could not be measured properly because of flocculation. Two groups were gotten to rank the cultures by eye and their results are given below.

% of phenol	0.3	0.2	0.1	0.05	0.02	0.01	0.005	0.002
Group 1	3	1	2	5	7	4	8	6
Group 2	3	2	1	4	5	7	6	8

Estimate the degree of correlation between the rankings of these two groups and hence test if the results are correlated. Note that the given data has been ranked already. (10 marks)

b) By first stating clearly the null and alternative hypothesis, apply U test at 1% level of significance to test whether medians are equal for the following pair of samples. (10 marks)

A	88	75	92	71	63	84	55	64	82	96				
B	72	65	84	53	76	80	51	60	57	85	94	87	73	61