BINDURA UNIVERSITY OF SCIENCE EDUCATION SFM224

BACHELOR OF STATISTICS AND FINANCIAL MATHEMATICS

APPLIED STATISTICS

Time : 3 hours

Candidates may attempt ALL questions in Section A and at most TWO questions in Section B. Each question should start on a fresh page.

SECTION A (40 marks)

Candidates may attempt ALL questions being careful to number them A1 to A4.

A1. State and explain any four measurement scales in non parametric statistics [8]

A2. Define the following terms

(a) Survey. [2]

(b) Run as used in run test. [2]

(c) Test statistic [2]

(d) Kurtosis [2]

(e) Hypotheses. [2]

A3. The table data shows sitting arrangement of men and women in a stadium. We would like to know whether we may conclude that the pattern is the result of an non random process [10]

MWMWMMMWMWMM
MWWMMMMWWMWM
MMWMMMWWWMWM
MMWMWMMMMWWM
MWMWMMMWMWMM
MWWMMMMWWMWM
MMWMMMWWWMWM
MMWMWMMMMWWM

A4. Two independent random samples were selected from each of the normal populations. The data is in the following table

Sample 1	84	79	56	41	40	39	59	44	60	61	
Sample 2	63	80	76	61	59	33	41	49	69	56	60

(a) Calculate S_p^2, the pooled estimator of σ^2. [2]

(b) Test at 5% significance level whether the two populations are the same. [7]

[10]

SECTION B (60 marks)

Candidates may attempt TWO questions being careful to number them B5 to B7.

B5. (a) The effectiveness of advertising for two rival products (Brand X and Brand Y) was compared. Market research at a local shopping center was carried out with participants being shown adverts for two rival brands of coffee which they rated on the overall likelihood of them buying the product (out of 10, with 10 being definitely going to buy the product). Half of the participants gave ratings for one of the products, the other half gave ratings for the other products.

	Brand X		Brand Y
Participant	Rating	Participant	Rating
1	3	1	9
2	4	2	7
3	2	3	5
4	6	4	10
5	2	5	6
6	5	6	8

Is there significant difference between the ratings given to each brand in terms of the likelihood of buying the product? (Use the Mann Whitney test) [13]

(b) Outline the main steps of hypothesis testing. [6]

(c) 10 patients were taken at random to asses the levels of blood pressure before and after oral contraception. The blood pressure of each patient before (X) and after (Y) are given in the following table.

X	46	62	54	44	38	32	51	44	38
Y	34	57	55	40	38	26	41	44	38

(i) Is this a matched pair or not? Explain. [3]

(ii) Is there significant difference between blood pressure before (X) and after (Y) oral contraception? [8]

B6. (a) A group of students have been asked to rate a sentence on a scale of acceptability from 0 (totally unacceptable) to 5 (totally acceptable) from informal spoken and formal written english. An investigator predicts that the sentence will be judged as more acceptable in informal spoken that formal written english. The scores are given in the table below.

Subject no	Informal spoken	Formal written
1	5	5
2	4	2
3	5	3
4	4	4
5	3	1
6	2	3
7	4	3
8	5	1
9	4	2
10	2	3
11	4	2
12	4	3
13	5	3
14	3	5
15	3	0

Is there significant difference between the two sets of scores? Apply the sign test. [13]

(b) Let X_1 be a random sample from the Poisson distribution with parameter μ. Suppose that we want to test the hypotheses

$$H_0 : \mu = 2 \text{ against } H_1 : \mu = 3$$

using the decision T: reject H_0 if $X > 2$. Calculate

(i) the probability of type I error. [4]

(ii) the probability of type II error. [4]

(iii) power of the test. [1]

(c) Let30, 22, 32, 26, 24, 40, 34, 36, 32, 33, 28, 30 be a realization from a certain population using the data-set. Calculate the coefficient of skewness and comment on the result. [4]

(d) Econometric data was generated to asses the effects of dollarization (x_1) and inflation (x_2)on economic growth (y). The analysis generated the linear model below.

$$y = 200 + 3.5x_1 - 11.1x_2$$

Comment on the model. [4]

B7. (a) An operations manager of a tire manufacturing company wants to determine whether there are any differences in the quality and type of shift. The following data was obtained

	Perfect	Satisfactory	Perfective
Shift 1	106	124	1
Shift 2	67	85	1
Shift 3	37	72	3

Asses at 5% level whether or not there is an association between quality and shift type. [13]

(b) A study on a group pf 8 people was conducted to ascertain whether or not physical exercise alleviate depression. Each person was randomly allocated to one of the three groups: 'no exercise', 20 minutes of jogging per day and 60 minutes of jogging per day. At the end of a month, each participant was asked to rate how depressed they now feel, on a Likert scale that runs from $1 - 100$. Below is a table of ratings

no exercise	20 minutes jogging	60 minutes jogging
23	22	59
26	27	66
51	39	38
49	29	49
58	46	56
37	48	60
29	49	56
44	65	62

Use the Kruskal Wallis test to test if physical exercise alleviate depression. [11]

(c) Define the following terms

(i) Test statistics [3]

(ii) Run as used in runs test. [3]

END OF QUESTION PAPER