

KABARAK



UNIVERSITY

**UNIVERSITY EXAMINATIONS
2008/2009 ACADEMIC YEAR
FOR THE DEGREE OF BACHELOR OF SCIENCE IN
ECONOMICS AND MATHEMATICS**

COURSE CODE: MATH 424

COURSE TITLE: NON PARAMETRIC STATISTICS

STREAM: Y4S2

DAY: WEDNESDAY

TIME: 9.00 – 11.00 A.M.

DATE: 02/12/2009

INSTRUCTIONS:

- (1) Answer question **ONE** and any other two Questions
- (2) Show your workings clearly

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

- (a) (i) Define a non-parametric test. Why should such a test be particularly useful when we must take a small sample?
- (ii) Explain briefly the circumstances in which we use the Wilcoxon signed rank test.
- (b) A pharmaceutical company has two different methods(A and B) available for analyzing potency in its drug used for treatment of bee stings. The results of the two methods are given below:

Method A	Method B
1.5	2.0
1.4	1.8
1.4	0.7
1.0	1.3
1.1	1.2
0.9	1.5
1.3	1.1
1.2	0.9
1.1	1.5
0.9	1.7
0.7	0.9
1.8	0.9

Use the sign test to determine whether method A yields consistently smaller results than B. Use $\alpha = 0.05$

- (c) Consider the following sequence of observations::

W W W W B W W W B B W B B

By using the runs test and $\alpha = 0.05$, determine whether the process produced random results.

- (d) The following data concerns the number of work stoppages (y) in the USA and the labour union membership (x) as a percentage of the civilian labor force for the period 1920-1970.

Year	(Y)	(X)
1920	3411	12.2
1925	1301	7.9
1930	637	7.5
1935	2014	7.1
1940	2508	16.1
1945	4000	27.5
1950	4843	24.1
1955	4320	27.3
1960	3333	26.0
1965	3963	24.9
1970	5716	25.1

- (i) Compute the Spearman's rank correlation coefficient(r_s) between X and Y
(ii) Test to see whether X and Y are positively correlated. $\alpha = 0.05$

QUESTION TWO (20 MARKS)

- (a) A company collected employee absenteeism data (in hours per day) at two of its manufacturing plants. The data were obtained by randomly selecting a sample from all of the employees at the first plant, and by randomly selecting another independent sample from all of the employees at the second plant. For each randomly selected employee, absenteeism records were used to determine the exact number of hours the employee has been absent during the past year. The following results were obtained:

Plant 1	Plant 2
10	21
131	46
53	53
37	31
59	49
29	33
45	39
26	19
39	12
36	35

Using the Mann- Whitney test, determine whether absenteeism is different at the two plants. Use $\alpha = 0.05$

- (b) A large bank wishes to limit the median debt-to equity ratio for its portfolio of commercial loans to 5.5. The bank randomly selects 15 of its commercial loan accounts. Audits result in the following debt-to equity ratios:

1.31 1.78 1.46 1.05 1.37 1.33 1.45 1.41 1.29

1.21 1.22 1.32 1.19 1.11 1.65

Use the Wilcoxon signed rank test at $\alpha = 0.05$ to decide whether the median debt-to equity ratio is less than 1.5.

QUESTION THREE (20 MARKS)

- (a) Consider the following data below on bottle designs A, B and C sales during a 24 hour period:

Design A	16 18 19 17 13
Design B	33 31 37 29 34
Design C	23 27 21 28 25

Use the Kruskal- Wallis test at $\alpha = 0.05$ to compare bottle designs A,B and C for the data above.

- (b) Consider the data below:

68.2 71.6 69.3 71.6 70.4 65.0 63.6 64.7 65.3 64.2 67.6 68.6 66.8
68.9 66.8 70.1

Test for randomness at $\alpha = 0.05$.

QUESTION FOUR (20 MARKS)

- (a) A marketing research firm wishes to study the relationship between coffee consumption and whether a person likes to watch professional tennis on television. One hundred randomly selected people are asked whether they drink coffee and whether they watch tennis. The following results are obtained:

	<i>Watch Tennis</i>	<i>Do not Watch Tennis</i>
Drink Coffee	16	24
Do not Drink Coffee	4	56

Test at $\alpha = 0.05$ the claim whether people who drink coffee are independent to those who watch tennis.

- (c) The shares of the U.S automobile market held in 1990 by General Motors(GM), Japanese manufactures(J), Ford (F), Chrysler(C), and other manufacturers(O) were respectively, 36%, 26%, 21%, 9% and 8%. Suppose that a new survey of 1000 new-car buyers shows the following purchase frequencies:

GM	J	F	C	O
391	202	275	53	79

Test to determine whether the current market shares differ from those of 1990. Use $\alpha = 0.05$