KABARAK 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 METHODS**

STREAM: **Y4S2**

DAY: **WEDNESDAY**

TIME: **2.00 – 4.00 P.M.**

DATE: **05/08/2009**

INSTRUCTIONS:

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

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

(a) (i) Give two disadvantages of using nonparametric methods over parametric methods.

   (ii) State two assumptions for the parametric procedures to hold.

(b)   A psychological experiment was conducted to compare the lengths of response time (in seconds) for two different stimuli. To remove the natural person to person variability in the responses, both stimuli were applied to each of the nine subjects, thus permitting an analysis of difference between response times within each person. The results are given in the below.

Subject	Stimuli 1	Stimuli 2
1.	9.4	10.3
2	7.8	8.9
3	5.6	4.1
4	12.1	14.7
5	6.9	8.7
6	4.2	7.1
7	8.8	11.3
8	7.7	5.2
9	6.4	7.8

Use the sign test to determine whether sufficient evidence exists to indicate a difference in the responses for the two stimuli. Use $\alpha = 0.05$

(c)   Consider the following sequence of observations::

$$\text{X X X Y X X Y Y Y X Y X Y X X Y Y Y Y X}$$

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

(d) How strong is the correlation between crude oil prices and prices of gasoline at the pump? In an effort ton estimate this association, an oil company analyst gathered the following data for several months:

Month	Crude oil Price	Gasoline price
1	$14.60	$1.05
2	10.50	1.06
3	12.30	1.08
4	15.10	1.06
5	18.35	1.12
6	22.60	1.24
7	28.90	1.36
8	31.40	1.40
9	26.75	1.34

(i)   Compute the Spearman's rank correlation coefficient(r_s) between crude oil price and gasoline price.

(ii)   Test to see whether it is significantly different from zero at $\alpha = 0.05$

QUESTION TWO (20 MARKS)

(a)   Do construction workers who purchase lunch from street vendors spend less than construction workers who go to restaurants? To test this question, a researcher selects two random samples of construction workers, one group that purchases lunch from street vendors and another that purchases lunch from restaurants. Workers are asked to record how much they spend on lunch that day.

Vendor	Restaurant
$ 2.75	$ 4.10
3.29	4.75
4.53	3.95
3.61	3.50
3.10	4.25
4.29	4.98
2.25	5.75
2.97	4.10
4.01	2.70
3.68	3.65
3.15	5.11
2.97	4.80
4.05	6.25
3.60	3.89
	4.80
	5.50

Using the Mann- Whitney test, test to analyse the data to determine whether street –vendor lunches are significantly cheaper than restaurant lunches. Let $\alpha = 0.05$

(b)   A random sample of 15 automobile mechanics certified to work on a certain type of car was selected and the time (in minutes) necessary for each one to diagnose a particular problem was determined, resulting in the following data:

30.6 30.1 15.6 26.7 27.1 25.4 35.0 30.8 31.9 53.2 12.5 23.2 8.8 24.9 30.2

Use the Wilcoxon signed rank test at $\alpha = 0.05$ to decide whether the data suggests that true average diagnostic time is less than 30 minutes.

QUESTION THREE (20 MARKS)

(a) Conside the following data below:

Group 1   19   21   29   22   37   42
Group 2   30   38   35   24   29
Group 3   39   32   41   44   30   27   33

Use the Kruskal- Wallis test at $\alpha = 0.05$ to determine whether there is a significant difference in the groups.

(b) Consider the data below:

12.4   31.8   22.2   24.5   17.9   24.6   15.7   27.3   22.7   26.0
14.5   22.0   21.8   31.9   11.5   28.3
Test for randomness at $\alpha = 0.05$.

QUESTION FOUR (20 MARKS)

(a) Consider the following contingency table on social class and the number of children

| | Social Class | | |
	Lower	Middle	Upper
Zero	7	18	6
One	9	38	23
Two or Three	34	97	58
More than Three	47	31	30

Test at $\alpha = 0.05$ the claim that social class is independent of the number of children per family.

(b)	In the business credit institution industry the accounts receivable for companies are classified as being **"current"**, **"moderately late"**, **"very late"** and **"uncollectable"**. Industry figures show that the ratio of these four classes is 9:3:3:1. Pratt Associates has 800 accounts receivable, with 439,168, 133 and 60 falling in each class. Are the numbers in agreement with the industry ratio? Use $\alpha = 0.05$