UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2008/2009

SUBJECT	:	MATHEMATICS III
CODE	:	BSM 2223
COURSE	:	1 BBV
DATE	:	APRIL 2009
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS IN **PART A** AND **TWO (2)** QUESTIONS IN **PART B**

THIS EXAMINATION PAPER CONSISTS OF 8 PAGES

PART A

Q1 (a) An oceanographer believes that the median height of the waves at Ocean City is greater than 2.8 meters. The wave heights are measured for a random sample of 12 days. The data are shown as in **Table Q1(a)**. Is there enough evidence to reject the oceanographer's claim ? Test the claim by using the sign test at the 0.05 significance level.

Table Q1(a) : Data of Wave Height

2.0	3.6	2.1	2.9	2.1	2.8	2.9	2.8	4.2	4.0	4.0	2.5

(10 marks)

(b) Eight couples are given a questionnaire designed to measure marital compatibility. After completing a workshop, they are given a second questionnaire to see whether there is a change in their attitudes toward each other. The data are shown in **Table Q1(b)**. By using Wilcoxon Signed-Rank (Table K - Appendix), test whether there are any difference in the scores of the couples at the 0.1 significance level.

Table Q1(b) : Data of Marital Compatibility

Before	45	61	34	29	67	63	51	55
After	49	59	37	30	61	69	60	74

(10 marks)

Q2 Radhi wishes to buy a car and he read a newspaper to find the price of the used car for a local compact car. The data of the age (in years) and the prices (RM in thousand) are shown in **Table Q2** below.

Table Q2 : Data of The Age (In Years) and The Prices (RM in Thousand)

Age (x)	1	2	3	4	5	6	7	8	9	10	11	12
Price (y)	33.4	29.3	29.0	28.1	27.5	26.0	24.2	19.5	14.7	14.0	13.4	13.0

(a) Sketch a scatter plot for the data.

(2 marks)

(b) Use the Least Squares Method to estimate the regression line. Interpret the results.

(8 marks)

(c) Estimate the car price when the cars are 14 years old.

(2 marks)

(d) Test the slope, β_1= -1 at 5% level of significance

(8 marks)

Q3 (a) The Ministry of Health wants to know whether the climate has changed since industrialization. Suppose that the mean temperature throughout history is 37 °C. During the last 20 years, the mean temperature has been 38 °C with a standard deviation of 2 °C.

Test the hypothesis with a significance level of 0.05.

(10 marks)

(b) A statistics lecturer wants to see whether current class has less variation than past classes. If 13 samples from previous semester scores have standard deviation of 14.1. Meanwhile, 11 samples from this semester have scores standard deviation of 10.3. Use a 0.01 level of significance to test the claim.

(10 marks)

PART B

Q4 (a) In the year five of a secondary school of 100 students, 57 studied mathematics, 59 studied chemistry, 44 studied physics, 26 studied both mathematics and physics, 33 studied both mathematics and chemistry, 13 studied chemistry but neither mathematics nor physics, 14 studied all three subjects.

(i) Draw the Venn diagram.
(ii) If a student is selected at random, find the probability that the student studied physics but neither mathematics nor chemistry.
(iii) If a student is selected from the physics class, find the probability that the student take all the subjects.
(iv) Find the probability that a student takes all the three subjects.

(10 marks)

(b) There are 50 students in the class where 22 of them are male students, and from it 18 of them pass their English test. For female students, there are 23 of them pass the English test.

(i) Construct a contingency table for the above situation.
(ii) Find the probability that the students are male and fail the test.
(iii) Find the probability that the students are female or past the test.
(iv) Find the probability that the students are female given that they fail the test.

(10 marks)

Q5 (a) The probability distribution function as in **Table Q4** below describes the number of repair calls that an appliance repair shop may receive during an hour.

Table Q4: The Probability Distribution Function of The Number of Repair Calls

Repair Calls	0	1	2	3
Probability	0.1	0.3	h	0.2

(i) Find the value of h.
(ii) What is the probability that there are at least two repair calls ?
(iii) Find $F(1)$.
(iv) How many calls should the shop expect per hour ?
(v) What is the standard deviation for the number of repair calls ?

(13 marks)

(b) The probability density function of the continuous random variable X is given as follows:

$$f(x)=\begin{cases}\dfrac{x}{2}; & 0<x<2\\ 0; & otherwise\end{cases}$$

(i) Show that X is a continuous random variable.
(ii) Find the probability that X is less than one.
(iii) Calculate the variance of X.

(7 marks)

Q6 (a) The insurance company in Muar had found that the probability that the customers fail to claim is 5%. Consider that the distribution is Binomial, 40 cover notes of insurance claims are selected at random by the company. Find the probability that

(i) not more than three cover notes are fails to claim
(ii) between two and five cover notes is fails to claim

(8 marks)

(b) Suppose 60% of the population approves of the job the governer is doing, and that 30 individuals are drawn at random from the population. Find the probability that

(i) more than ten individuals approve the governer's job
(ii) exactly eleven individuals approve the governer's job

(12 marks)

Q7 (a) According to the 2004 *Malaysia Metrological Station*, the average wind speed in Sibu Island is 18.2 km/h. Assume that the wind speed is normally distributed with a standard deviation of 5.6 km/h. Calculate the probability that

(i) the wind speed on any one reading will exceed 26.2 km/h
(ii) the mean of a random sample of 4 readings will exceed 26.2 km/h
(iii) the mean of a random sample of 40 readings will be at least 2 km/h different from the average speed

(10 marks)

(b) The average cholesterol content in Brand A egg is 215 milligrams and the standard deviation is 15 milligrams. Meanwhile, average for Brand B is 224 milligrams and standard deviation is 10 milligrams. Assume the variable is normally distributed.

(i) If samples of 20 eggs from Brand A and 17 eggs from Brand B are selected, find the probability that the mean cholesterol contend in Brand B is more than in Brand A.
(ii) If a sample of 25 eggs from Brand A and 40 eggs from Brand B are selected, find the probability that the mean of the Brand B is at least ten milligrams will more than Brand A.

(10 marks)

Q8 (a) When people smoke, the nicotine they absorb is converted to continine, which can be measured. A sample of forty smokers has a mean continine level of 172.5 and standard deviation of 119.5. Find a 90% confidence interval estimate of the mean continine level of all smokers.

(6 marks)

(b) A sample of 14 cans of Brand I diet soda gave the mean number of calories of 23 per can with a standard deviation of 3 calories. Another sample of 16 cans of Brand II diet soda gave the mean number of calories of 25 per can with a standard deviation of 4 calories. Assume that the calories per can of diet soda are normally distributed for each of the two brands and the variances for the two populations are equal. Find the 99% confidence interval for $\mu_1 - \mu_2$.

(7 marks)

(c) A medical researcher wants to determine whether male pulse rates vary more or less than female pulse rates. The statistics that he found from his research can be summarized as in **Table Q8(c)**.

Table Q8 (c) : Statistics Summary for Pulse Rate

Male	Female
Number of samples : 7	Number of samples : 9
Mean : 69.4	Mean : 76.3
Standard deviation : 11.3	Standard deviation : 12.5

Construct 95% of confidence interval for the ratio variance between male and female.

(7 marks)

Appendix

Table K Critical Values for the Wilcoxon Signed-Rank Test

Reject the null hypothesis if the test value is less than or equal to the value given in the table.

	One-tailed, $\alpha = 0.05$	**$\alpha = 0.025$**	**$\alpha = 0.01$**	**$\alpha = 0.005$**
n	**Two-tailed, $\alpha = 0.10$**	**$\alpha = 0.05$**	**$\alpha = 0.02$**	**$\alpha = 0.01$**
5	1			
6	2	1		
7	4	2	0	
8	6	4	2	0
9	8	6	3	2
10	11	8	5	3
11	14	11	7	5
12	17	14	10	7
13	21	17	13	10
14	26	21	16	13
15	30	25	20	16
16	36	30	24	19
17	41	35	28	23
18	47	40	33	28
19	54	46	38	32
20	60	52	43	37
21	68	59	49	43
22	75	66	56	49
23	83	73	62	55
24	92	81	69	61
25	101	90	77	68
26	110	98	85	76
27	120	107	93	84
28	130	117	102	92
29	141	127	111	100
30	152	137	120	109

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FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2008/2009 COURSE : 1 BPD / 2 BPD

SUBJECT : STATISTICS FOR MANAGEMENT (REAL ESTATE) CODE : BSM 1822

Formulae

Probability :

$P(\bar{A}) = 1 - P(A)$, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$, $P(A) = \dfrac{n(A)}{n(S)}$, $0 \le P(A) \le 1$,

$\sum P(A) = 1$, ${}^nC_r = \binom{n}{r} = \dfrac{n!}{r!(n-r)!}$, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$,

$P(A \cup B) = P(A) + P(B)$, $P(B \mid A) = \dfrac{P(B \cap A)}{P(A)}$, $P(B_k|A) = \dfrac{P(B_k) \times P(A|B_i)}{\sum_{i=1}^{n} P(B_i) \times P(A|B_i)}$, $k = 1, 2, \dots, n.$.

Random Variable :

$\sum_{i=-\infty}^{\infty} P(x_i) = 1$, $E(X) = \sum_{\forall x} x \cdot P(x)$, $E(X^2) = \sum_{\forall x} x^2 \cdot P(x)$, $\int_{-\infty}^{\infty} f(x)\,dx = 1$, $E(X) = \int_{-\infty}^{\infty} x \cdot P(x)\,dx$,

$Var(X) = E(X^2) - [E(X)]^2$.

Special Probability Distributions :

$P(x = r) = {}^nC_r \cdot p^r \cdot q^{n-r}, r = 0, 1, \dots, n$, $X \sim B(n, p)$, $P(X = r) = \dfrac{e^{-\mu} \cdot \mu^r}{r!}$, $r = 0, 1, \dots, \infty$,

$X \sim P_0(\mu)$, $Z = \dfrac{X - \mu}{\sigma}$, $Z \sim N(0, 1)$, $X \sim N(\mu, \sigma^2)$.

Sampling Distributions :

$\bar{X} \sim N(\mu, \sigma^2/n)$, $Z = \dfrac{\bar{X} - \mu}{\sigma/\sqrt{n}} \sim N(0, 1)$, $T = \dfrac{\bar{x} - \mu}{s/\sqrt{n}}$, $\bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}\right)$.

Estimations :

$n = \left(\dfrac{Z_{\alpha/2} \cdot \sigma}{E}\right)^2$, $\left(\bar{x}_1 - \bar{x}_2\right) - Z_{\alpha/2}\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + Z_{\alpha/2}\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$,

$\left(\bar{x}_1 - \bar{x}_2\right) - Z_{\alpha/2}\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + Z_{\alpha/2}\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}$,

$\left(\bar{x}_1 - \bar{x}_2\right) - t_{\alpha/2,v} \cdot S_p\sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + t_{\alpha/2,v} \cdot S_p\sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}$

where Pooled estimate of variance, $S_p^2 = \dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$ with $v = n_1 + n_2 - 2$,

$\left(\bar{x}_1 - \bar{x}_2\right) - t_{\alpha/2,v}\sqrt{\dfrac{1}{n}\left(s_1^2 + s_2^2\right)} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + t_{\alpha/2,v}\sqrt{\dfrac{1}{n}\left(s_1^2 + s_2^2\right)}$ with $v = 2(n-1)$,

$$\left(\bar{x}_1-\bar{x}_2\right)-t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}} \text{ with } v=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}},$$

$$\frac{(n-1)\cdot s^2}{\chi^2_{\alpha/2,v}}<\sigma^2<\frac{(n-1)\cdot s^2}{\chi^2_{1-\alpha/2,v}} \text{ with } v=n-1,$$

$$\frac{s_1^2}{s_2^2}\cdot\frac{1}{f_{\alpha/2}(v_1,v_2)}<\frac{\sigma_1^2}{\sigma_2^2}<\frac{s_1^2}{s_2^2}\cdot f_{\alpha/2}(v_2,v_1) \text{ with } v_1=n_1-1 \text{ and } v_2=n_2-1.$$

Hypothesis Testings :

$$Z=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}},\ T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{S_p\cdot\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \text{ with } v=n_1+n_2-2,$$

$$Z=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}},\ T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{1}{n}\left(s_1^2+s_2^2\right)}},\ T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}} \text{ with}$$

$$v=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}}.$$

Simple Linear Regressions :

$$S_{xy}=\sum x_iy_i-\frac{\sum x_i\cdot\sum y_i}{n},\ S_{xx}=\sum x_i^2-\frac{\left(\sum x_i\right)^2}{n},\ S_{yy}=\sum y_i^2-\frac{\left(\sum y_i\right)^2}{n},\ \bar{x}=\frac{\sum x}{n},\ \bar{y}=\frac{\sum y}{n},$$

$$\hat{\beta}_1=\frac{S_{xy}}{S_{xx}},\ \hat{\beta}_0=\bar{y}-\hat{\beta}_1\bar{x},\ \hat{y}=\hat{\beta}_0+\hat{\beta}_1x,\ r=\frac{S_{xy}}{\sqrt{S_{xx}\cdot S_{yy}}},\ SSE=S_{yy}-\hat{\beta}_1S_{xy},\ MSE=\frac{SSE}{n-2},$$

$$T=\frac{\hat{\beta}_1-\beta_1^*}{\sqrt{\frac{MSE}{S_{xx}}}}\sim t_{n-2},\ T=\frac{\hat{\beta}_0-\beta_0^*}{\sqrt{MSE\left(\frac{1}{n}+\frac{\bar{x}^2}{S_{xx}}\right)}}\sim t_{n-2}.$$