UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	STATISTICS
COURSE CODE	:	BIT 11603
PROGRAMME	:	1 BIT
EXAMINATION DATE	:	JUNE 2013
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER ANY **FIVE (5)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Using a Tree Diagram, show the probability of getting 2 heads from 3 tosses of a coin in a row is $\frac{3}{8}$?

(5 marks)

(b) By Binomial Distribution, compute the probability of getting exactly 3 heads from 5 tosses of a fair coin.

(5 marks)

(c) Given X ~N(mean, variance) where the mean is 500 hours and standard deviation is 100 hours. Compute the probability that a candidate selected at random will require less than 580 hours to complete a specific task?

(5 marks)

(d) What is a Central Limit Theorem?

(5 marks)

Q2 (a) The following data are given

$$P(A) = \frac{3}{14}, P(B) = \frac{1}{6}, P(C) = \frac{1}{3}, P(A \text{ and } C) = \frac{1}{7} \text{, and } P(B|C) = \frac{5}{21}.$$

Find the values of:

(i) $P(A|C)$

(ii) $P(C|A)$

(iii) $P(B \text{ and } C)$

(iv) $P(C|B)$

(10 marks)

(b) Given the probability function X is $f(x) = \begin{cases} \frac{3}{4}x(2-x) & , \quad 0 \le x \le 2 \\ 0 & , \quad \text{otherwise} \end{cases}$

(i) Show that the $f(x)$ is continuous random variable.

(2 marks)

(ii) Sketch the graph of $f(x)$

(2 marks)

(iii) Find $E(X)$

(2 marks)

(iv) Find $Var\ (X)$

(4 marks)

Q3 (a) What are Type I and Type II errors in Hypothesis Testing?

(3 marks)

(b) A private hospital reports that the average cost of rehabilitation for cancer victims is RM25,000. To see if the average cost of rehabilitation is different at a particular hospital, a researcher selects a random sample of 35 cancer victims at the hospital and finds that the average cost of their rehabilitation is RM26,500. The standard deviation of the population is RM3,250.
At $\alpha = 0.01$, show whether he can reject or accept his null hypothesis?

(9 marks)

(c) An attorney claims that more than 25% of all lawyers advertise their service through the internet. A sample of 200 lawyers in a certain city showed that 63 had used internet to advertise their services. At $\alpha = 0.05$, prove the attorney's claim? (Hint: use the p value method).

(8 marks)

Q4 (a) If X_1, X_2, X_3 is a random sample of three independent observations taken from a population with mean μ and variance σ^2. Analyze estimators below for μ are unbiased, and which is the most efficient.

$$T_1 = \frac{X_1 + X_2 + X_3}{3}, T_2 = \frac{X_1 + 2X_2}{3}, T_3 = \frac{X_1 + 2X_2 + 3X_3}{3}$$

(12 marks)

(b) The mean number of watching live TV football World Cup per week was μ=10.5 and the standard deviation is σ is 3.6 among male university students. A simple random sample of 16 students is chosen at random for a study of viewing habits involving South Korean football team. Let $\bar{x}$ be the mean number of hours of TV watched by the sampled students.

(i) Find the mean $\mu_{\bar{x}}$

(ii) The standard deviation of $\sigma_{\bar{x}}$ of $\bar{x}$

(8 marks)

Q5 (a) Two manufacturers A and B make the same type of component. Manufacture A sells them in boxes of 100 and B in boxes of 50. A customer has noticed that the chance of getting 5 or more defects in a box is the same in each case, namely, 0.045. Calculate the percent of defective in both A and B. If A now started to sell components in boxes of 50, find the probability that the customer will get a box from A containing 5 or more defects?

(10 marks)

(b) Two brands of torch batteries have the same average life, 60 hours but different standard deviations of 1.5 and 2.25 hours. Find in each case the probability that a battery will not have a life longer than 56 hours?

(10 marks)

Q6 (a) You are given the following report. You are asked to advise which of the two restaurants below is making more money per day. Explain your reasons.

(12 marks)

	Restaurant Type			Statistic	Std. Error
POST_ RESTORATION	1	Mean		1.1667	.08419
		95% Confidence Interval for Mean	Lower Bound	.9945	
			Upper Bound	1.3389	
		5% Trimmed Mean		1.1667	
		Median		1.0000	
		Variance		.213	
		Std. Deviation		.46113	
		Minimum		.00	
		Maximum		2.00	
		Range		2.00	
		Interquartile Range		.00	
		Skewness		.670	.427
		Kurtosis		1.132	.833
	2	Mean		1.5667	.28237
		95% Confidence Interval for Mean	Lower Bound	.9892	
			Upper Bound	2.1442	
		5% Trimmed Mean		1.3148	
		Median		1.0000	
		Variance		2.392	
		Std. Deviation		1.54659	
		Minimum		1.00	
		Maximum		7.00	
		Range		6.00	
		Interquartile Range		.00	
		Skewness		2.832	.427
		Kurtosis		7.038	.833

(b) Explain the rationale of doing

(i) Random sampling

(ii) Stratified sampling

(iii) Cluster sampling

(8 marks)

FINAL EXAMINATION

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Table 1: Descriptive Statistics

$\mu = \frac{\sum_{i=1}^{n} x_i}{N}$	$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$
$\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \mu)^2}{N}$	$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$
$M = L_m + C(\frac{\frac{n}{2} - F}{f_m})$	$M_0 = L + C(\frac{d_1}{d_1 + d_2})$
$\bar{D} = \frac{\sum_{i=1}^{n}\lvert x_i - \bar{x}\rvert}{n}$	$\bar{D} = \frac{1}{\sum_{i=1}^{n} f_i}(\sum_{i=1}^{n} f_i\lvert x_i - \bar{x}\rvert)$

Table 2: Probability Distribution

Binomial $X \sim B(n,p) = \binom{n}{r} p^r (1-p)^{n-r}$ for $n = 0,1,\ldots,n$
Poisson $X \sim P_O(\mu) = \frac{e^{-\mu}\mu^r}{r!}$ for $n = 0,1,2\ldots$
Normal $X \sim N(\mu, \sigma^2)$, $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-[\frac{(X-\mu)^2}{2\sigma^2}]}$
Standard Normal $Z \sim N(0,1)$, $f(z) = \frac{1}{\sqrt{2\pi}} e^{-(\frac{z^2}{2})}$, $Z = \frac{X-\mu}{\sigma}$

Table 3 : Sampling, Estimation and Hypothesis Testing

$\bar{X} \sim N(\mu, \frac{\sigma^2}{n})$	$\bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma^2{}_1}{n_1} + \frac{\sigma^2{}_2}{n_2}\right)$
$z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$	$Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma^2{}_1}{n_1} + \frac{\sigma^2{}_2}{n_2}}}$

Table 3 : Sampling, Estimation and Hypothesis Testing

$e = \pm z_{\frac{\alpha}{2}}\left(\frac{\sigma}{\sqrt{n}}\right)$ or $\pm z_{\frac{\alpha}{2}}\left(\frac{s}{\sqrt{n}}\right)$	$\bar{X} \pm Z_{\frac{\alpha}{2}}\left(\frac{\sigma}{\sqrt{n}}\right)$
$\bar{X} \pm Z_{\frac{\alpha}{2}}\left(\frac{s}{\sqrt{n}}\right)$	$\bar{X} \pm t_{\frac{\alpha}{2},n-1}\left(\frac{s}{\sqrt{n}}\right)$
$(\bar{X}_1 - \bar{X}_2) \pm Z_{\frac{\alpha}{2}}\sqrt{\frac{{\sigma_1}^2}{n_1} + \frac{{\sigma_2}^2}{n_2}}$	$(\bar{X}_1 - \bar{X}_2) \pm Z_{\frac{\alpha}{2}}\sqrt{\frac{{s_1}^2}{n_1} + \frac{{s_2}^2}{n_2}}$
$(\bar{X}_1 - \bar{X}_2) \pm Z_{\frac{\alpha}{2}}S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ where ${S_p}^2 = \frac{(n_1-1){s_1}^2+(n_2-1){s_2}^2}{n_1+n_2-2}$	$(\bar{X}_1 - \bar{X}_2) \pm t_{\frac{\alpha}{2},v}\sqrt{\frac{{s_1}^2}{n_1} + \frac{{s_2}^2}{n_2}}$ where $v = \frac{\left(\frac{{s_1}^2}{n_1} + \frac{{s_2}^2}{n_2}\right)^2}{\frac{(\frac{{s_1}^2}{n_1})^2}{n_1 - 1} + \frac{(\frac{{s_2}^2}{n_2})^2}{n_2 - 1}}$
$(\bar{X}_1 - \bar{X}_2) \pm t_{\frac{\alpha}{2},v}S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ where ${S_p}^2 = \frac{(n_1-1){s_1}^2+(n_2-1){s_2}^2}{n_1+n_2-2}$, $S_p = \sqrt{{S_p}^2}$	$\frac{(n-1)s^2}{\chi^2_{\frac{\alpha}{2},v}} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_{1-\frac{\alpha}{2},v}}$
$\frac{{s_1}^2}{{s_2}^2}\frac{1}{f_{\frac{\alpha}{2}}(v_1,v_2)} < \frac{{\sigma_1}^2}{{\sigma_2}^2} < \frac{{s_1}^2}{{s_2}^2}f_{\frac{\alpha}{2}}(v_2,v_1)$	$T = \frac{\bar{X} - \mu}{\frac{s}{\sqrt{n}}}$
$\hat{\beta} = \frac{S_{xy}}{S_{xx}}$	$t = \frac{\hat{\beta}}{\sqrt{Var(\hat{\beta})}}$ where $Var(\hat{\beta}) = \left(\frac{S_{yy} - \hat{\beta}S_{xy}}{n-2}\right)(\frac{1}{S_{xx}})$

- END OF QUESTION -