INTI International College Subang
LAUREATE INTERNATIONAL UNIVERSITIES®

FINAL
Examination Paper

(COVER PAGE)

Session	:	August 2012
Programme	:	Diploma In Business (DIB) Diploma In Information And Communication Technology (DICTN)
Course	:	**STA1101: QUANTITATIVE METHODS**
Date of Examination	:	December 14, 2012
Time	:	5:00pm – 7:00pm Reading Time: Nil
Duration	:	2 Hours
Special Instructions	:	

Answer any **FOUR (4)** structured-type questions.

Materials permitted :

Non-programmable Calculator

Materials provided :

Graph paper, Formula Booklet 2

Examiner (s)	:	**Ms. Cetha Achutan Nair,** Tan Seng Kuan, Teoh Ching Nee, Bark Chee Beng, Elizabethrani Allappan.
Moderator	:	Dr. Ng Set Foong

This paper consists of 8 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE SUBANG

DIPLOMA IN BUSINESS PROGRAMME (DIB)
DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
STA 1101 : QUANTITATIVE METHODS
FINAL EXAMINATION : AUGUST 2012 SESSION

Instructions : This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1 (25 marks)

(a) The number of items rejected daily by a manufacturer because of defects was recorded for the last 25 days. The results are as follows:

21	8	17	22	19	18	19	14	17	11	6
19	9	12	16	16	10	29	24	6	21	20
21	25	25								

(i) Construct a frequency distribution for these data with class intervals 5 – 9, 10 – 14,.... (3 marks)

(ii) Construct a frequency histogram for these data. (4 marks)

(b) In a survey, the following questions were asked. Identify the type of data (whether they are qualitative or quantitative)

(i) What is your age?

(ii) On which floor do you live?

(iii) Do you own or rent?

(iv) How many square metres is the living area?

(4 marks)

(c) An insurance company looks at the records for millions of homeowners and sees that the mean loss from fire in a year is $250 per house and that the standard deviation of the loss is $1,000. The company plans to sell fire insurance for $250 enough to cover its costs and profit. If the company sells 10,000 policies, what is the approximate probability that the average loss in a year will be greater than $275?

(5 marks)

(d) Using the company records for the past 200 working days, the manager of D & N Motors, a suburban automobile dealership, has summarized the number of cars sold per day into the following table.

Number of cars sold per day	Frequency of occurrence
0	20
1	70
2	30
3	30
4	50

(i) Form the probability distribution of the number of cars sold per day. (3 marks)

(ii) Compute the mean number of cars sold per day. (2 marks)

(iii) What is the probability that on any given day

(a) fewer than 4 cars will be sold? (2 marks)

(b) at least 3 cars will be sold? (2 marks)

Question 2 (25 marks)

(a) Suppose that the lifetime of a particular electronic circuit has a normal distribution with mean 50,000 hours and standard deviation 8,000 hours.

(i) What is the probability that a randomly selected circuit will last less than 30,000 hours? (3 marks)

(ii) What is the probability that a randomly selected circuit will last more than 55,000 hours? (3 marks)

(b) Suppose SAT scores are normally distributed with a mean of 1000 and a standard deviation of 100. How high must the score be to be in the top 2% of all scores? (3 marks)

(c) A random sample of 100 books is selected from the library. The average age of the books is 24.3 years and the standard deviation of the sample is 16 years. Compute a 95% confidence interval for the true age of the books in the library. (4 marks)

(d) The director of manufacturing at a clothing factory needs to determine whether a new machine is producing a particular type of cloth according to the manufacturer's specifications, which indicate that the cloth should have a mean breaking strength of 70 pounds and a standard deviation of 3.5 pounds. A sample of 49 pieces of cloth reveals a sample mean breaking strength of 69.1 pounds.

(i) State the null and alternative hypotheses. (1 mark)

(ii) Is there evidence that the machine is not meeting the manufacturer's specification for average breaking strength? (Use a 0.05 level of significance) (5 marks)

(iii) What would be your answer in (ii) if the standard deviation were specified as 1.75 pounds? (4 marks)

(e) State **TWO (2)** of assumptions of the binomial distribution. (2 marks)

Question 3 (25 marks)

(a) The following table shows a random sample of 100 hikers and the areas of hiking preferred:

Sex	The Coastline	Near Lakes and Streams	On Mountain Peaks	Total
Female	18	16	11	45
Male	16	25	14	55
Total	34	41	25	100

If one person from the study is chosen at random, what is the probability that the person is

(i) female (1 mark)

(ii) female and prefers hiking on mountain peaks. (2 marks)

(iii) male given that the person prefers hiking near lakes and streams. (2 marks)

(iv) female or prefers hiking on mountain peaks. (2 marks)

(b) A large corporation is interested in determining whether an association exists between the commuting time of its employees and the level of stress-related problems observed on the job. A study of 90 assembly line workers reveals the following:

	Stress		
Commuting Time	High	Moderate	Low
Under 15 min	12	6	18
15 – 45 min	18	8	28

At the 0.01 level of significance, is there evidence of a significant relationship between commuting time and stress? (10 marks)

(c) Warranty records show that the probability that a new car needs a warranty repair is 0.05. If a sample of 3 new cars is selected, what is the probability that

(i) None of the cars need a warranty repair? (2 marks)

(ii) At least one needs a warranty repair? (2 marks)

(iii) What are the mean and the standard deviation of the probability distribution? (4 marks)

Question 4 (25 marks)

(a) Various measures for a sample of 8 sporty cars were examined to investigate whether there is a relationship between luggage capacity and gas consumption in sporty cars? The following data represent the luggage capacity(cubic feet) and the corresponding gas consumption (miles per gallon) for this sample.

Luggage Capacity	Gas consumption
11	28
11	29
13	27
14	25
15	22
19	20
18	24
14	24

(i) Compute the coefficient of correlation. (6 marks)

(ii) Interpret your finding in part (a). (1 mark)

(iii) Compute the value of coefficient of determination and interpret its value. (3 marks)

(iv) Compute the regression equation. (5 marks)

(v) Use the regression equation to estimate the gas consumption of a sporty car with a luggage capacity of 12 cubic feet. (2 marks)

(b) The hotel industry is very interested in understanding how tourists spend money. In order to measure the price changes in 3 important components of a tourist's budget, a statistician calculated the average cost of a hotel room (one night), a meal and a car rental (one day) in 1985 and in 2009. The results is shown below:

Component	1985 Cost $	2009 Cost $
Hotel (one day)	55	210
Meal	10	25
Car (one day)	25	69

(i) Calculate a simple aggregate index to reflect the costs in 2009, taking 1985 as the base year. (2 marks)

(ii) Suppose that in 1985, the average tourist stayed in the hotel for 6 days, ate 8 meals at the hotel and rented a car for 2 days. In 2009 the average tourist stayed in the hotel for 4 days, ate 6 meals at the hotel and rented a car for 3 days. Calculate Laspeyres price index with base 1985=100. (4 marks)

(c) IQ test scores are normally distributed with a mean of 100 and a standard deviation of 15. An individual's IQ score is found to be 110. Find the z-score corresponding to this value. (2 marks)

Question 5 (25 marks)

(a) A random sampling of police records show the following number of crimes were committed in a city for each day of the week:

Day	Number of crimes
Sunday	74
Monday	64
Tuesday	58
Wednesday	68
Thursday	79
Friday	98
Saturday	119

Test the hypothesis at the 0.05 level that there is a uniform distribution in the number of crimes committed each of the week. (9 marks)

(b) A telecommunications company is considering introducing HD videos on demand (VOD) in an areas that currently does not have any such facilities. The company will introduce VOD if there is evidence that more than 5000 of the 20,000 households in the area are equipped with HD televisions. It conducts a telephone poll of 300 randomly selected households in the area and finds that 96 have HD televisions. What would be the decision of the company using a significance level of 0.05? (8 marks)

(c) The ages of the seven employees of a pizza shop are as follows:

19 19 65 20 21 18 21

(i) Calculate the mean, the median and the mode of the employees' ages. (6 marks)

(ii) How would these three measures of central location be affected if the oldest employee retired?

(2 marks)

Question 6 (25 marks)

(a) The purchasing director for an industrial parts factory is investigating the possibility of purchasing a new type of milling machine. She determines that the new machine will be bought if there is evidence that the parts produced have a higher average breaking strength that those from the old machine. The population standard deviation of the breaking strength for the old machine is 10 and for the new machine is 9 kilograms. A sample of 100 parts taken from the old machine indicates a sample mean of 65 kilograms, whereas a similar sample of 100 from the new machine indicates a sample mean of 72 kilograms. Using the 0.01 level of significance, is there evidence that the purchasing director should buy the new machine? (7 marks)

(b) An analyst who works for a call centre that handles customer complaints for a large Energy firm thinks that the number of calls received in a 1 hour period has a Poisson distribution with an average number of calls per hour of 12.

(i) If the analyst observes the number of calls that are received in a 15 minute period, what is the probability that exactly 2 calls will be received? (3 marks)

(ii) Find the mean and variance of the number of calls in a 15 minute period. (2 marks)

(c) The following data are the third and fourth round scores of a random sample of five competitors in an open golf tournament.

Competitor	A	B	C	D	E
3^{rd} round	76	75	72	75	79
4^{th} round	70	73	71	68	76

Use a paired t-test and a 5% significance level to test whether there is a difference in the mean score of all competitors in the two rounds. (10 marks)

(d) Define the following terms:

(i) population

(ii) sample

(iii) mutually exclusive events

(3 marks)

-The End-

BUSINESS STATISTICS and QUANTITATIVE METHODS - Formulae List

Descriptive Statistics

	UNGROUPED	GROUPED
Mean	$\frac{\sum x}{n}$	$\frac{\sum fm}{\sum f}$
Population variance	$\frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N}$	$\frac{\sum fm^2 - \frac{(\sum fm)^2}{\sum f}}{\sum f}$
Sample variance	$\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}$	$\frac{\sum fm^2 - \frac{(\sum fm)^2}{\sum f}}{\sum f - 1}$

Binomial Distribution

$$P(X = x) = {}^{n}C_{x}\, p^{x} q^{n-x}$$

Poisson Distribution

$$p(x; \mu) = \frac{e^{-\mu}\mu^{x}}{x!}$$

Sampling Distributions of Mean

$\sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n}}$ when population variance is known.

$\sigma_{\overline{X}} = \frac{s}{\sqrt{n}}$ when population variance is unknown.

The z value of a value of $\overline{X}$ is calculated as : $Z = \frac{\overline{X} - \mu}{\sigma_{\overline{X}}}$

Sampling Distributions of Proportion

$$\sigma_p = \sqrt{\frac{\pi(1-\pi)}{n}}$$

The z value for a value of p is calculated as : $Z = \frac{p - \pi}{\sigma_p}$

Discrete Probability Distribution

$$\mu = E(x) = \sum xP(x)$$

$$\sigma^2 = \sum x^2 P(x) - \mu^2$$

(1-α)100% CONFIDENCE INTERVAL FOR μ

$\overline{X} \pm Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$ if population variance is known.

$\overline{X} \pm Z_{\alpha/2} \frac{s}{\sqrt{n}}$ if population variance is unknown and n≥30.

$\overline{X} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$ if population variance is unknown and n < 30.

Hypothesis Testing

When population variance is known, $z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$

When population variance is unknown and $n \geq 30$, $z = \frac{\bar{x} - \mu}{s / \sqrt{n}}$

When population variance is unknown and $n < 30$, $t = \frac{\bar{x} - \mu}{s / \sqrt{n}}$

For Proportion $z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$

Testing the Difference between Two Means, and Two Proportions

Comparing two means (large independent samples):

$$z = \frac{(\overline{X}_1 - \overline{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

Comparing two means (small independent samples, variances equal):

$$t = \frac{(\overline{X}_1 - \overline{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Comparing two means for small dependent samples

$$t = \frac{\overline{D} - \mu_D}{s_D / \sqrt{n}} \quad \text{where} \quad \overline{D} = \frac{\sum D}{n} \quad \text{and} \quad s_D = \sqrt{\frac{\sum D^2 - \frac{(\sum D)^2}{n}}{n - 1}}$$

Correlation and Regression

Correlation Coefficient :

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}}$$

The regression line equation: $y' = a + bx$

Where
$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$
$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

Chi-Square and Analysis of Variance

Chi-square test for goodness of fit:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Chi-square test for independence and homogeneity of proportions:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

BUSINESS STATISTICS and QUANTITATIVE METHODS - Formulae List

Descriptive Statistics

	UNGROUPED	GROUPED
Mean	$\frac{\sum x}{n}$	$\frac{\sum fm}{\sum f}$
Population variance	$\frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N}$	$\frac{\sum fm^2 - \frac{(\sum fm)^2}{\sum f}}{\sum f}$
Sample variance	$\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}$	$\frac{\sum fm^2 - \frac{(\sum fm)^2}{\sum f}}{\sum f - 1}$

Binomial Distribution

$$P(X = x) = {}^nC_x p^x q^{n-x}$$

Poisson Distribution

$$p(x;\mu) = \frac{e^{-\mu}\mu^x}{x!}$$

Sampling Distributions of Mean

$\sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n}}$ when population variance is known.

$\sigma_{\overline{X}} = \frac{s}{\sqrt{n}}$ when population variance is unknown.

The z value of a value of $\overline{X}$ is calculated as : $Z = \frac{\overline{X} - \mu}{\sigma_{\overline{X}}}$

Sampling Distributions of Proportion

$$\sigma_p = \sqrt{\frac{\pi(1-\pi)}{n}}$$

The z value for a value of p is calculated as : $Z = \frac{p - \pi}{\sigma_p}$