WESTERN SYDNEY UNIVERSITY
Final Exam – Spring Session 2015

School of Computing, Engineering and Mathematics

EXAM INSTRUCTIONS	
Read all the information below, and follow any instructions carefully before proceeding. You must comply with all directions given by Exam Supervisors. You may begin writing when instructed by the Exam Supervisor at the start of the exam. Clearly indicate which question you are answering on any Examination Answer Booklets used.	
Unit Name:	Quantitative Thinking
Unit Number:	300831
Number of Questions:	Five (5)
Total Number of Pages:	Three (3) (excluding exam cover sheet)
Value of Questions:	The question values are as follows: Question 1: 7 marks. Question 2: 18 marks. Question 3: 8 marks. Question 4: 12 marks. Question 5: 5 marks. The total for all questions in the exam paper is 50 marks.
Answering Questions:	Answer *all* questions in the Examination Answer Booklets provided. Full justification and/or working must be shown to obtain full marks for questions.
Lecturer/Unit Coordinator:	Dr. Charles Zworestine
Time Allowed:	2 hours

RESOURCES ALLOWED	
Only the resources listed below are allowed in this exam.	
Any calculator which has the primary function of a calculator is allowed. For example, calculators on mobile phones or similar electronic devices are not allowed.	

DO NOT TAKE THIS PAPER FROM THE EXAM ROOM

EXAM – 300831 SPRING 2015   (No page number – coversheet only)

Question 1   [(2 + 2) + (1 + 2) = 7 marks]

(a)   The speed of light is approximately 1.08×10^9 kilometres per hour.

     (i)   What is the speed of light in metres per second? Answer in scientific notation.

     (ii)   How far does light travel in miles in one year? Again answer in scientific notation. You may assume that one kilometre is 0.62 miles, and one year is 365.25 days.

(b)   Consider the formula

$$M = D \times V$$

    where M denotes the mass of an object, D denotes its density and V denotes its volume.

     (i)   Rearrange this formula to make D the subject.

     (ii)   You have a small rock with a volume of 0.003 litres and a mass of 0.06 kilograms. What is its density? Answer in grams per cubic centimetre.

Question 2   [(1 + 1 + 2) + (2 + 2) + (2 + 2) + (1 + 2 + 2 + 1) = 18 marks]

(a)   The data below is a sample of the number of years of experience for six randomly chosen employees at a small computer firm.

$$2, 2, 3, 5, 7 \text{ and } 15.$$

     (i)   What is the median number of years of experience?

     (ii)   What is the mean number of years of experience?

     (iii)   What is the sample standard deviation of number of years of experience?

(b)   A group of laboratory animals is infected with a particular form of bacteria. Their survival time is found to be normally distributed, with a mean of 28 days and a standard deviation of 12 days.

     (i)   What percentage of these animals will survive for less than 16 days?

     (ii)   Given that the probability that one of these animals survives for less than 36 days is 0.7486 (to 4 decimal places), find the probability that one of these animals survives for between 20 and 36 days.

(c)   Standards set by government agencies indicate that Australians should not exceed an average daily sodium intake of 3300 milligrams (mg). To find out whether Australians are exceeding this average, a sample of 100 Australians is selected, and the mean and standard deviation of daily sodium intake found. From statistical software, the data yields a p-value of 0.1814. We wish to investigate whether this sample information indicates that the average daily sodium intake exceeds 3300 mg. Use a significance level of $\alpha = 0.05$.

      (i)   State the null and alternate hypotheses required to conduct this investigation.

      (ii)   What is your conclusion from this investigation?

(d)   A study was conducted to determine the effects of sleep deprivation on people's ability to solve problems without sleep. A total of 8 subjects were deprived of sleep for a specified period, then asked to perform a set of simple addition problems for which the number of errors was recorded. The results are summarised in the table below.

Number of hours without sleep, x	16	18	20	22	24	-26	28	30
Number of errors, y	8	12	14	15	16	18	22	24

A scatter plot of the data collected is illustrated below.
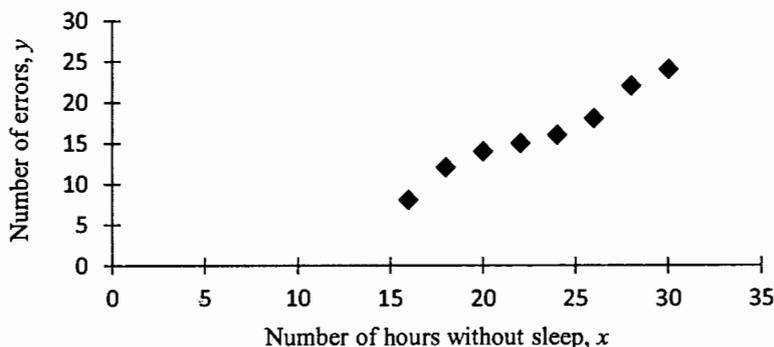
      (i)   Using the above scatter plot, describe any relationship that exists between the variables.

      (ii)   The regression equation for the collected data is

$$y = 1.0417x - 7.8333.$$

           What is the slope of the regression equation? Interpret its meaning here.

      (iii)   The correlation coefficient for the data collected above is $r = 0.9820$. What does this tell us about the relationship between x and y?

      (iv)   Use the regression equation above to predict the number of errors that will be made by a person who goes for 32 hours without sleep.

Question 3   [2 + (1 + 2 + 3) = 8 marks]

(a)   Simplify the expression

$$\frac{121^{-n} \times 11}{11^{3n}}.$$

(b)   Solve the following equations for x.

    (i) $8x - 7 = 13$;

    (ii) $3x^2 + 2x - 8 = 0$;

    (iii) $\log_2 (x + 5) - \log_2 (x - 1) = 2$.

Question 4   [(2 + 3 + 4) + 3 = 12 marks]

(a)   The rabbit population on a certain island, measured from the start of 1995, can be found by the formula

$$P(t) = 1000 e^{0.12t},$$

where $P(t)$ denotes the rabbit population on the island after t years.

    (i)   What is the rabbit population on this island at the start of 1995?

    (ii)   What is the predicted rabbit population on this island at the start of 2000? Answer to the nearest 10 rabbits.

    (iii)   How long will it take from the start of 1995 until the rabbit population on this island triples? Answer to the nearest month.

(b)   Suppose that 35 men can harvest all the wheat in a very large field in 8 days. How many days would it take 20 men to harvest all the wheat in the same field?

Question 5   [5 marks]

At a party, everybody shook hands exactly once with everybody else. There were a total of 66 handshakes. How many people were at the party?

END OF EXAMINATION PAPER