RMIT UNIVERSITY

EXAM COVER SHEET

NOTE: This exam paper may be RETAINED by the student

EXAM DETAILS

Course Code:	**MATH1324**				
Course Description:	**Statistical Methods**				
Date of exam:	24/06/2010	**Start time of exam:**	17:45 PM	**Duration of exam:**	2hr 15min

Total number of pages (incl. this cover sheet) 5

ALLOWABLE MATERIALS AND INSTRUCTIONS TO CANDIDATES

1. Write your full name and student number on each exam booklet together with the number of exam books used.
2. Students must not write, mark in any way any exam materials, read any other text other than the exam paper or do any calculations during reading time.
3. All mobile phones must be switched off and placed under your desk. You are in breach of exam conditions if it is on your person (ie. pocket).
4. This is a **LIMITED TEXT** Exam.

   Students may bring in one (1) textbook of their choice, with annotations and tabs, two (2) A4 sheets of paper (back and front totally four (4) sides of paper) and a calculator.
5. Commence each question on a new page. Carry out the instructions on the front cover of the exam script book and the front of this exam paper.
6. Non text storing calculators are allowed.
7. Electronic dictionaries are allowed.
8. All eight (8) questions may be attempted for a total of sixty (60) marks.
9. Questions do not have to be answered in sequential order.
10. Please start each question on a new page.
11. Marks will be allocated for correct working shown.

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1. At a hospital's emergency room, patients are classified and 20% of them are critical, 30%are serious and the remainder are stable. Of the critical ones 30% die; of the serious 10% die; and of the stable 1% die.
   a) What is the probability that the next patient to enter the emergency room is not stable and survives?
   b) Given a patient dies, what is the probability that the patient was classified as critical?

(2 + 3 = 5 marks)

2. Bartholomew did not study for his Chemistry test and has no idea about the correct answers. It is a multiple choice test with 20 questions, each with five possible answers, of which exactly one is correct. If Bartholomew selects answers at random;
   a) What is the probability that he scores less than 10 out of 20?
   b) How many should he expect to get correct?

(2 + 2 = 4 marks)

3. A continuous random variable X has the following probability density function.

$$f(x) = \begin{cases} 2e^{-2x} & x \geq 0 \\ 0 & elsewhere \end{cases}$$

   a) What sort of distribution is this?
   b) Calculate $P(X < 1)$.
   c) State the expected value and variance of X.
   d) Hence or otherwise, calculate the mean and variance of another random variable Y, where, $Y = 2 - 3X$.

(1 + 2 + 2 + 2 = 7 marks)

4. The weight of mature female Red Kangaroos (*Macropus rufus*) is approximately normally distributed. 15 mature female red kangaroos were harvested and weighed and found to have a mean weight of 23.7kg with a standard deviation of 1.8kg.

   a) Obtain a 90% confidence interval for μ, and interpret what this means.

   b) If one more female red kangaroo was harvested, give a 99% prediction interval for her weight.

(3 + 2 = 5 marks)

5. A new process for extracting aluminium from bauxite is tested in terms of its yield (in kg) of aluminium. The results are summarised in the Minitab output given below. It is noted that both the samples tests for normality do not fail.

Descriptive Statistics: Old Process, New Process

Variable	Total Count	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Old Process	13	15.092	1.803	12.644	13.813	14.503	16.368	19.102
New Process	16	18.61	7.34	2.86	11.99	19.85	24.11	29.73

   a) Construct an appropriate hypothesis test to see if the new process is better in terms of its yield, stating and testing any required assumptions.

   b) Does this experiment provide evidence to back up the null hypothesis at the 0.05 level of significance?

(4 + 4 = 8 marks)

6. After a flight from Los Angeles to Melbourne, several passengers from business and economy class were asked to rate their experience of the flight out of ten (0= horrible, 10 = excellent).

Business class	10	9	7	8	9	8
Economy class	4	5	9	6	5	2

Apply a Wilcoxon test to see if there is a significant difference between the passengers experience, using $\alpha = 0.05$.

(5 marks)

7. Does the education of the parents affect the child's score on a proficiency test? A study of 279 children was done, where they were administered a test and the educational level of the parent with the higher level was recorded. The categories for the educational level were less than high school, high school graduate, some university, university graduate. The overall unbiased estimator for variance was 1034 and the sum of squares for the treatments was 45496.

   a) Construct a one-way ANOVA table to test the null hypothesis that there is no difference between the children's test scores based on their parent's level of education.

   b) Use the critical value (α = 0.05) of the F distribution to test the null hypothesis from part a).

   c) Comment on the part of the *"Tukey 95% Simultaneous Confidence Intervals"* given in the Minitab output shown below.

```
Tukey 95% Simultaneous Confidence Intervals
All Pairwise Comparisons

Individual confidence level = 98.92%


Less than HS subtracted from:

          Lower  Center  Upper  -----+---------+---------+---------+----
HS grad   -5.16   10.95  27.06               (-----*------)
Some uni  10.89   26.55  42.22                     (------*-----)
Uni grad  19.95   35.84  51.73                          (-----*------)
                                -----+---------+---------+---------+----
                                   -25         0        25        50


HS grad subtracted from:

          Lower  Center  Upper  -----+---------+---------+---------+----
Some uni   2.47   15.60  28.74                (----*----)
Uni grad  11.49   24.89  38.29                     (----*----)
                                -----+---------+---------+---------+----
                                   -25         0        25        50


Some uni subtracted from:

          Lower  Center  Upper  -----+---------+---------+---------+----
Uni grad  -3.58    9.29  22.15             (----*----)
                                -----+---------+---------+---------+----
                                   -25         0        25        50
```

(4 + 2 + 2 = 8 marks)

8. It is thought that rainfall in June effects the blueberry production in the USA. The rainfall (mm) at one blueberry farm was monitored for 12 years as was the blueberry production (tonnes). Some summary statistics are given below;

$$\sum x_i = 114.48, \sum y_i = 74.41, \sum x_i^2 = 1366.65, \sum y_i^2 = 645924 \text{ and } \sum x_i y_i = 489.5$$

a) Find the equation of the least squares regression line for the relationship between blueberry production (y) and rainfall (x).

b) Predict the blueberry production when June has 8mm of rainfall.

c) What does the following Minitab output tell us about the suitability of the regression model?

Regression Analysis: Blueberry production versus Rainfall

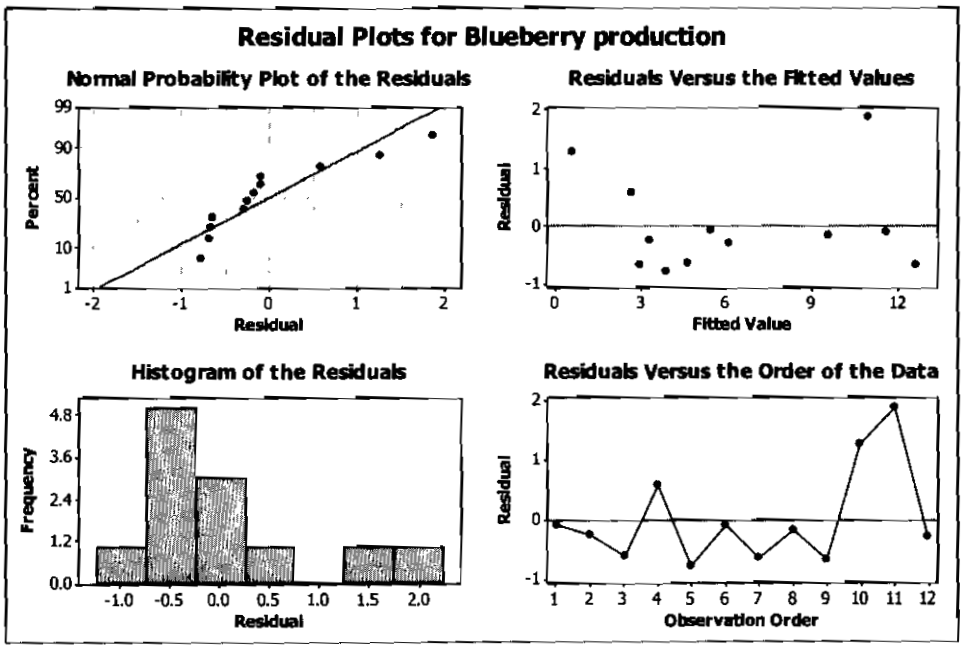
The regression equation is
Blueberry production = Rainfall

Predictor	Coef	SE Coef	T	P
Constant		0.5631	24.61	0.000
Rainfall		0.05277	-15.21	0.000

S = 0.874306 R-Sq = 95.9% R-Sq(adj) = 95.4%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	176.87	176.87	231.38	0.000
Residual Error	10	7.64	0.76		
Total	11	184.51			



(4 + 1 + 3 = 8 marks)