

1. The assignment **MUST** be submitted electronically to Turnitin before the due date.
2. The assignment is due at **5:00pm on Wednesday, 18 October 2017**. Late assignments will be penalised 10% per day or part thereof for 4 days and the assignment will no longer be accepted after 5:00pm on Sunday, 22 June 2017. **Solutions will be posted on Blackboard after all students submit their assignment.**
3. Your answers shall be provided as a word-processed report giving full explanation and interpretation of any results you obtain. Excel (including add-ins such as Data Analysis and Data Analysis Plus) may be used for calculation for all questions and you should include any relevant Excel output (or graphs) in your report. Output without explanation will receive **zero** marks.
4. Be warned that plagiarism between individuals is always obvious to the marker of this assignment.
5. The data sets for this assignment can be found in the Excel file "QBUS5001-2017S2-Assignment-Data.xlsx".
6. Written presentation of the assignment is part of the assignment. Markers will assign up to 10% of the mark for clarity of writing and written presentation.
7. Numbers with decimals, e.g. p-values, should be reported to the fourth decimal point.

1. **[50 points]** You have recently commenced a graduate role at a financial services firm. Your boss has asked you to investigate the performance of two of its biggest rivals; Australia New Zealand Banking Group (ANZ) and the Commonwealth Bank of Australia (CBA). She is also interested in testing your skills as a graduate, and has assigned you a third stock to investigate that she has randomly allocated to you from the Australian stock market (see sheet Q1 of the dataset file). Your analysis will involve monthly adjusted closing prices of all three stocks for the five years from 01 November 2011 to 01 November 2016.

- (i) **[2 points]** Find your allocated stock by typing your student ID (SID) number into the data spreadsheet. **IN YOUR OWN WORDS**, write a short paragraph (3-4 sentences) describing the company whose stock you have been assigned. Answers that copy sentences from Wikipedia will receive 0 marks.

Using the adjusted closing prices, create a series of percentage monthly returns for each stock. The percentage monthly return for ANZ, for example, can be found using the following formula;

$$r_{a,t} = 100 \times \frac{a_t - a_{t-1}}{a_{t-1}}$$

where a_t is the adjusted closing price of ANZ at time t .

- (ii) **[2 points]** For each of the three stocks, find the mean percentage return and the standard deviation of the percentage returns. Present this information in a neat table, using 4 decimal places for each value presented (for example, a monthly return of 1.0341% and a standard deviation of 0.2954% are each presented to 4 decimal places).
- (iii) **[6 points]** Create two line charts. The first illustrating the monthly closing prices of each of the three stocks of interest (one line for each stock), the second comparing the monthly percentage returns of each stock. By using your charts only, can you tell which stock has the highest return? Which stock seems to have the highest variance? Explain.
- (iv) **[4 points]** Using a parametric test at the 5% level of significance, test whether the mean monthly percentage return of your allocated stock is positive. Would your answer change if you used a 1% level of significance?
- (v) **[4 points]** Using a parametric test at the 1% level of significance, test whether the mean monthly percentage return of CBA is greater than 0.4%. What is the p-value associated with this test?
- (vi) **[4 points]** Using a parametric test at the 10% level of significance, test whether the mean monthly percentage return of your allocated stock differs from ANZ assuming (a) equal variance and (b) unequal variances. What assumptions have you made by conducting this parametric test?
- (vii) **[4 points]** Test, at the 5% level of significance, whether or not the variances of the monthly percentage return of your allocated stock and ANZ are equal. Hence, comment on the conclusion you make in (vi).
- (viii) **[6 points]** Redo (vi) using non-parametric methods. Here we can make the assumption that the variances are equal.

Consider a new Australian stock called "Gaussian Bank Ltd" (GBL). The monthly returns for GBL are distributed normally with a mean of 0.75% and a standard deviation of 1.1%.

- (ix) **[6 points]** What is the probability of GBL achieving a negative return in any given month? What is the probability of GBL achieving 2 or more negative monthly returns in a given year?

- (x) **[4 points]** Simulate 60 random monthly returns for GBL. GBL's share price at 01 November 2011 is \$8.50. Use the random percentage returns you've created to generate a series of monthly share prices for GBL over the period 01 November 2011 to 01 November 2016. Re-produce the line plots from part (iii) with GBL included.
- (xi) **[4 Points]** Produce a correlation matrix of returns for the four stocks (CBA, ANZ, GBL and your allocated stock). Comment on whether the correlations are as you would expect.
- (xii) **[4 Points]** Artem wants to invest in both CBA and ANZ stocks. What proportion of the portfolio should be invested in CBA such that the resulting portfolio has a minimum variance? What is this minimum variance?

2. **[10 points]** A consumer organization was interested in the differences in demand for three competing brands. In a preliminary study, weekly sales figures of these three brands at a local supermarket were recorded, over a period of 6 weeks (see Sheet Q2 of the dataset file). To analyse the data, they considered the following one-way ANOVA model

$$y_{ij} = \mu_i + \varepsilon_{ij}, \quad i = 1, \dots, 3; j = 1, \dots, 6$$

Use $\alpha = 0.01$ for all hypothesis tests below.

- (i) **[3 points]** Perform a formal parametric test for the equality of the weekly sales figures of these three brands. State any assumptions required for this test.
- (ii) **[3 points]** Perform a multiple comparison test. State all hypotheses and conclusions to fully explain the output.
- (iii) **[4 marks]** Perform a formal non-parametric test for the equality of the weekly sales figures of these three brands.

3. **[10 points]** In an executive MBA unit, the managing director of a courier service learnt a training program to improve employee's work efficiency. She modified this training program and then recruited 30 randomly selected employees to participate in the training program. Before joining this training program, each employee's work efficiency was measured by a score sheet (min. 0 point, max. 100 points). Upon the

completion of the training program, employee's work efficiency was measured again. The data was recorded in Sheet Q3 of the data file. The managing director believed that her training program can improve employee's work efficiency by at least 10 points.

- (i) **[4 points]** Do you think that the managing director's claim is supported by the data? Use Excel to answer this question and use $\alpha = 0.05$.
- (ii) **[6 points]** State the assumption that you have made above and test, at the 5% level of significance, whether or not this assumption is correct.

4. **[15 points]** During a promotion period, the number of mortgage applications received by a bank on a particular business day is assumed to follow a Poisson distribution with mean $\mu = 8$. The bank is open from 9am to 5pm from Monday to Friday.

- (i) **[3 points]** Find the probability that at least 7 applications are received on a business day. Verify your answer using MS Excel.
- (ii) **[4 points]** Find the probability that more than 45 applications are received on 5 business days using MS Excel. You do not need to calculate the individual probabilities manually.
- (iii) **[4 points]** Find the probability that the bank does not receive any application in the first hour after it opens for business on a particular day.
- (iv) **[4 points]** What is the distribution of the time between arrival of consecutive mortgage applications and what are the mean and variance of that distribution?

5. **[20 points]** Perform an analysis to solve the case provided below. Note that there are 20 marks awarded here, so we are expecting a professional report drawing on various parts of the QBUS 5001 course material. In particular you should conduct statistical tests and consider any assumptions you make along the way. The data set is available in sheet Q5 of the data file.

C18-04 The academic book business is different from most other businesses because of the way purchasing decisions are made. The customer, who is usually a student studying a university or TAFE subject, buys a specific book because the lecturer of the subject adopts (chooses to use) that book. Sales representatives of publishers sell their products by persuading lecturers to adopt their books. Unfortunately, judging the quality of textbooks is not easy. To help with the decision process, sales representatives give free examination copies to lecturers so that they can review the book and decide whether or not to adopt it. In many universities, there are several sections of the same subject, and book adoption committees meet to make the adoption decision.

The Senior Publishing Editor, Mr Geoff Howard, at Cengage Learning Australia was examining the latest data on the sales of recently published textbooks. He noted that the number of examination copies was quite large, which can be a serious problem given the high cost of producing books. The editor wonders whether his sales representatives were giving away too many free books, or perhaps not enough. The data contains the gross revenues from the sales of the books, and the number of free copies for 20 books. The publishing editor would like to know if there is a direct link between the number of free copies of a book and the gross revenue generated by that book.

Perform an analysis to provide the publisher with the information they need.

6. **[10 points]** Complete the following tasks:

- (i) **[5 points]** A study is trying to estimate the difference between the annual salaries paid to female and male employees working for the same large company. They take a random sample of 60 females and find that their average annual salary is \$76 500 with a standard deviation of \$1 250. They take a random sample of 65 males and find that their average annual salary is \$79 500 with a standard deviation of \$2 500. Find and interpret a 95% confidence interval for the difference in annual salaries for female and male employees of this large company.
- (ii) **[5 points]** A statistician investigating the relationship between the amount of precipitation (in inches) and the number of car accidents gathered data for 10 randomly selected days. The results are presented below. Calculate the Spearman rank correlation coefficient, and test to determine at the 5% significance level whether we can infer that a linear relationship exists between the number of accidents and the amount of precipitation.

Day	Precipitation	Number of accidents
1	0.03	2
2	0.12	6
3	0.05	7
4	0.02	3

5	0.10	8
6	0.35	14
7	0.15	7
8	0.30	12
9	0.15	7
10	0.20	10

End of Questions