SEMESTER 1 EXAMINATIONS 2015-16

FOUNDATIONS OF BUSINESS ANALYTICS

DURATION: 120 MINUTES (2 HOURS)

This paper contains **FOURTEEN** questions.

Answer **TWELVE** questions in total.

Answer **ALL TEN** questions in **SECTION A** and **TWO** questions from **SECTION B**.

Section A carries 40% of the marks and you should aim to spend about 45 minutes on it.

Section B carries 60% of the marks and you should aim to spend about 75 minutes on it.

An outline marking scheme is shown in brackets to the right of each question.

Only University approved calculators may be used.

A foreign language word to word translation dictionary (paper version) is permitted provided it contains no notes, additions or annotations.

Normal Distribution Tables will be provided.

SECTION A
You must answer ALL questions in this section.

A1. The 150 staff who work at Southampton Business School were asked how they normally travel to the university. The results are tabulated by gender in the table below.

|	Male	Female
Walk	22	18
Bus	16	20
Train	12	11
Car	25	13
Bike	8	5

If a staff member is selected at random, what is the probability that they

(a) travel by train   [1 mark]
(b) are a male who does not travel by car   [2 marks]

A2. A social scientist takes a sample of 300 Southampton residents aged 20 and above, and measures a number of variables, as shown below. State whether the following variables are categorical nominal, categorical ordinal, quantitative discrete or quantitative continuous:

(a) Years in current residence   [1 mark]
(b) Annual income   [1 mark]
(c) Occupation   [1 mark]
(d) Age, in 10-year age bands   [1 mark]
(e) Number of bedrooms in house   [1 mark]

A3. A delivery company recorded the delivery costs for 39 small packages it delivered one day last week. A histogram of the delivery costs is shown below.

Histogram of delivery costs
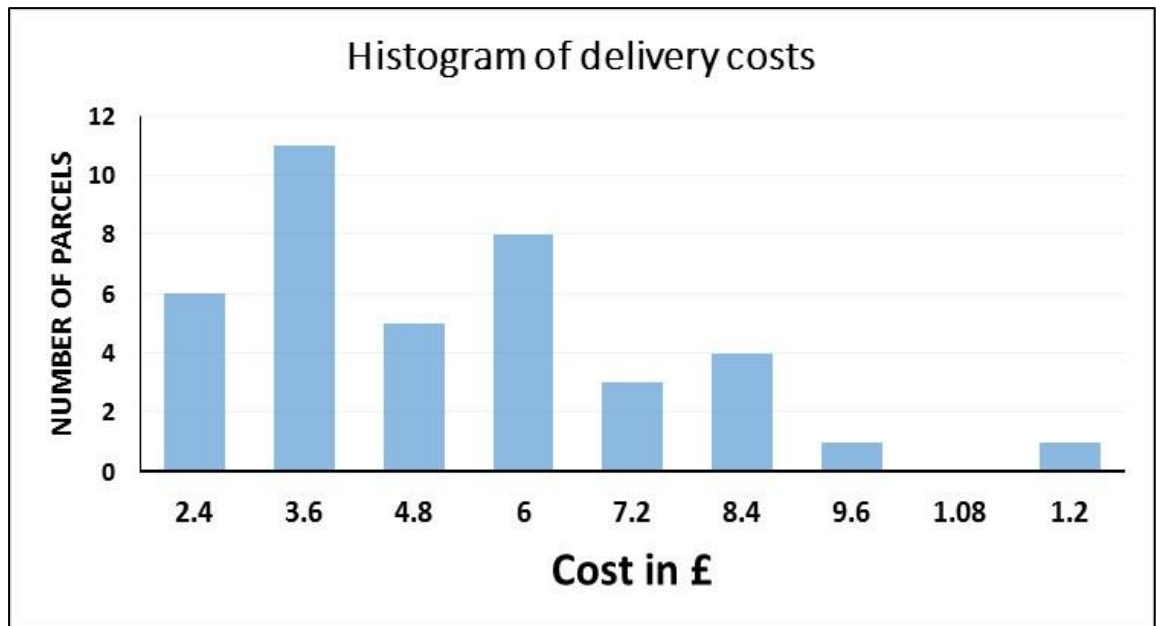
(a) Describe the shape of this histogram. [1 mark]

(b) A manager at the delivery company recorded the mean and median delivery cost, but unfortunately lost the paper on which the values were recorded. However, she remembered that one value was £4.00 and the other was £4.40. Which value is the mean and which is the median?

    (i) £4.00 is the mean and £4.40 is the median
    (ii) £4.40 is the mean and £4.00 is the median
    (iii) It's impossible to tell from the information provided
[2 marks]

TURN OVER

A4. An inspector needs to learn if customers are getting less of a soft drink than the 280ml stated on the label. After she collects data from a sample of bottles, she is going to conduct a test of a hypothesis. She should use:

(a) a two tailed test
(b) a one tailed test with an alternative to the right
(c) a one tailed test with an alternative to the left
(d) either a one or a two tailed test because they are equivalent
(e) none of the above

[2 marks]

A5. The salaries (in £000) of a sample of ten employees of a small company are given in the table below.

14	28	31	45	62	67	81	110	135	170

(a) Calculate the sample mean [1 mark]
(b) Calculate the sample standard deviation [3 marks]
(c) Are there any outliers in the sample? Explain. [4 marks]

A6. Optimization is always better than simulation, because optimization gives an exact answer whereas simulation always just gives an estimate. Do you agree? Explain your answer.

[4 marks]

A7. John works for a camera shop. Last month, he was the top salesman in the southeast region and received a cash bonus of £1,000. He is wondering whether to invest this bonus on the stock market, or to put it in a building society account which pays a guaranteed 4% per annum. If he invests the money on the stock market, there is a 30% chance that the stock will double in value after a year, but a 70% chance that the stock will only be worth 60% of its current value. Which option should John choose? [4 marks]

A8. In clinical trials a certain drug has a 25% success rate of curing a known disease. If 5 people with the disease take this drug, what is the probability of exactly 3 of them being cured? [3 marks]

A9. Sales of pizzas at Guilio's Pizza Parlour for the past three weeks are as shown in the table below.

Week beginning	Sales
September 1	50
September 8	65
September 15	52

(a) Forecast the sales (rounded up) for the week beginning September 22, using the 3 period moving average method [2 marks]

(b) Forecast the sales (rounded up) for the week beginning September 22, using weights of 0.5, 0.3, 0.2 for the most recent, next recent, and most distant data, respectively [2 marks]

A10. In a sample there are 1000 "good" and 100 "bad" customers. Among them there are 200 "good" and 50 "bad" customers with the given attribute of a characteristic X. What is the Weight of Evidence (WoE) of this attribute? [4 marks]

TURN OVER

SECTION B
You must answer TWO questions from this section.

B1. Rainbow Designs is a small company that manufactures and sells electronic toys and gadgets. The new product for winter 2015 is a lightweight camera drone in the shape of Santa's sleigh. Based on historical data, the company predicts that the demand for this product for the coming Christmas follows a discrete probability distribution as below.

Demand	100	110	120	130	140	150
Probability	0.1	0.2	0.3	0.25	0.15	0.1

Therefore, demand will always be a multiple of 10, and will be between 100 and 150.

The fixed cost of producing the drone is £10,000, the variable cost is £80 per item, and the selling price is £100 per item. There is a single opportunity for Rainbow Designs to produce these drones for the coming Christmas period, and any that do not sell this season can be sold to discounters at end of January for a price of £30 per item.

(a) Find the expected value and standard deviation of demand for the winter season. [6 marks]

(b) Suppose that Rainbow Designs decide to produce 136 items for the coming winter. Calculate the expected profit (or loss), and the probability of making a loss.
[24 marks]

B2. On average last year a local leisure centre had 230 customers per day. The distribution of customers was found to be Normal, with a standard deviation of 27. The distribution of every day is independent from the distribution of other days. Determine the probability that:

(a) On any one day the centre has more than 270 customers. [6 marks]

(b) On any one day the centre has less than 210 customers. [6 marks]

(c) On any one day the centre has between 225 and 250 customers. [6 marks]

(d) There are three consecutive days with less than 210. [6 marks]

(e) There are five consecutive days in which two days have less than 210 customers, and three days have more than 270 customers (these days can be in any order). [6 marks]

TURN OVER

B3. This question has two parts.

(a) Global market research has shown that in general, only 18% of people are influenced by TV advertising for airlines. Tim Optimist, head of marketing at Wizzy Airlines, has tested a new TV advert on a sample of 80 people and found that after viewing it, 22% of them said they would definitely fly Wizzy next time. On this evidence, Tim has put forward a business case to use the advert in a (costly) prime time TV campaign.

   (i) Write down in words the null hypothesis H_0 and the alternative hypothesis H_1. [2 marks]

   (ii) Write down in words what a Type 1 error represents. What is the consequence of this for Wizzy Airlines? [2 marks]

   (iii) Write down in words what a Type 2 error represents. What is the consequence of this for Wizzy Airlines? [2 marks]

(b) Taxi drivers from Southampton regularly take passengers to Heathrow Airport. There are two possible routes (labelled A and B), both of which take about an hour. The time taken for a random sample of 35 journeys by each route has been collected and the sample means and standard deviations calculated, as tabulated below.

	Sample mean	Sample SD
Route A	60.6	8.4
Route B	63.9	13.6

   Carry out an appropriate statistical test, at 5% and 1% level of significance, to see whether or not there is a difference between the mean travel times by the two routes. Do you need to make any assumptions to carry out this test? If so, what are they? [24 marks]

B4. This question has two parts.

(a) A manager in the company Space Systems Ltd wishes to award a research contract to a consulting firm. There are two contenders for the contract: firm A and firm B. The bids that the companies make are 10K and 8K respectively. It is, however, not clear whether the consultants are capable of completing the research. If the research project fails then the firm still gets paid. If it is successful then Space Systems Ltd achieves a one-time saving of 15K. Based on previous experience, the manager assesses the likelihood of success by the two companies as 80% and 70% respectively.
Which consultant should be chosen?

[15 marks]

(b) At a cost, the manager can gain more insight, and better estimate the probabilities of success. The manager can invite firm B to make extended research proposal at a cost of £1,000 per consultant. He will classify the proposal into good or poor. He estimates that the probability of a good proposal if the project can finish successfully is 0.7 and 0.1 if the project would fail. Is it worth commissioning the extra report?

[15 marks]

END OF PAPER