

**CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

Autumn Examinations 2018

Module Title: Quantitative Techniques for Management

Module Code: MATH6033

School: Business

Programme Title(s): Bachelor of Business in Accounting
Bachelor of Business in Accounting (Hons)

Programmes Code(s): BACCT_7_Y1
BACCT_8_Y1

External Examiner(s): Professor Michael Wallace

Internal Examiner(s): Dr Shane O Rourke

Instructions: Answer **THREE** questions.
All questions carry equal marks.

Duration: 2 hours

Sitting: Autumn 2018

Requirements for this examination:

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination. If in doubt please contact an Invigilator.

1. (a) The HR manager of a company has recorded the number of hours worked by employees in the company. Her figures are as follows.

41.2	42.3	39.6	39.5	38.9	44.4	43.4	43.2	43.8	39.1
44.2	43.5	42.0	43.1	42.4	42.4	42.8	42.9	43.1	39.8
41.3	40.0	39.6	39.7	42.1	39.8	44.3	46.2	41.3	40.8
39.3	45.1	45.6	45.6	46.1	45.0	43.5	39.2	39.2	39.1

- (i). Form a frequency distribution table for the data with six class intervals of equal width. (6 marks)
- (ii). Form a histogram for the data. (4 marks)
- (iii). Use the histogram to estimate the mode of the data. (5 marks)
- (b) Suppose that A and B are two events with $P(A|B) = 0.7$, $P(B|A) = 0.4$ and $P(A \cap B) = 0.3$. (6 marks)
- (i). Find $P(A)$, $P(B)$ and $P(A \cup B)$. (4 marks)
- (ii). Are A and B independent? Mutually exclusive? (4 marks)
- (c) A drug has been developed which is believed reduces the risk of a certain disease. The disease affects 0.1% of the general population, but only affects 0.04% of those people who take the drug. In a particular group of 100 people, suppose that 5 people have taken the drug. A person in this group goes on to contract the disease. Find the probability that this person took the drug. (8 marks)

2. (a) The following data gives the hourly sales figures in a supermarket over a sample of different times of the day over a weekly period.

Sales (€)			Number of hours
0	but less than	20	4
20	but less than	30	8
30	but less than	40	12
40	but less than	60	6
60	but less than	80	5
80	but less than	100	3
100	but less than	150	2

Calculate

- (i). the mean (4 marks)
- (ii). the standard deviation (6 marks)
- (iii). the mode (4 marks)
- (iv). the median (4 marks)
- of the data.
- (b) GH Consulting is introducing a new computer system in its head office. To do this eight main activities have been identified that must be performed. These activities, their expected durations and the constraints on the order in which they may be performed are summarised as follows.

Activity	Preceding activity	Duration (months)
A	J	2
B	-	2
C	B	4
D	-	1
E	C,F	2
F	D	3
G	A,H	3
H	D	2
I	J	4
J	D	7

- (i). Represent the data on a network diagram. (7 marks)
- (ii). Calculate the minimum project time and give the critical path(s). (5 marks)
- (iii). Which activities (if any) could be delayed by one month without delaying the project completion time? (3 marks)

3. (a) The quarterly sales figures of Ilda supermarkets are summarised as follows. (Figures are given in thousands of euros.)

Year	2015	2016	2017
Quarter 1	640	960	1280
Quarter 2	990	1430	1870
Quarter 3	900	1260	1620
Quarter 4	1320	1800	2280

- (i). Plot the data on a time series graph. (4 marks)
- (ii). Calculate the centred four-quarter moving averages for the data. (6 marks)
- (iii). Using an additive or multiplicative model calculate a seasonal index for each quarter. (6 marks)
- (iv). Seasonally adjust the production figures for the last two quarters of 2017. (4 marks)
- (b) The average prices of apartments sold by an estate agent over a three-year period was measured. These figures are given in the table below, along with the number of each type sold in the same period.

	Price (€000)			Quantity		
Year	2015	2016	2017	2015	2016	2017
One-bedroom	58	45	54	74	50	45
Two-bedroom	67	60	69	88	71	64
Three-bedroom	88	76	79	81	66	59

- (i). Calculate a Laspeyres price index for 2017 taking 2016 as the base year. (6 marks)
- (ii). Calculate the Weighted Arithmetic Mean of Price Relatives Index for 2017 with 2015 = 100 and taking the 2016 values as weights. (7 marks)

4. (a) A satellite TV channel is investigating whether there is a correlation between the length of commercial breaks and the number of viewers. A marketing research firm conducted a survey the channel and reported the following results.

Length of commercial break (minutes)	1.4	6.5	4.4	5.2	7.9	3.6	6.0	2.8
Number of viewers (thousands)	16	11	13	9	5	15	8	13

- (i). Plot the scatter diagram for the data. (4 marks)
- (ii). Find the equation of the regression line, and fit this line to your graph. (6 marks)
- (iii). Estimate the number of viewers that would be expected when the commercial breaks are 5 minutes long. (3 marks)
- (b) An investor is considering three options for where to invest a lump sum of €500,000 for one year.
- His first option is to invest the money in the Bank of New North Scotland. It is considered that deposits there are relatively safe with a probability of only 0.01 that his investment would be lost within the year. Moreover interest rates are fixed at 0.5%, so he would be guaranteed this return on his investment (assuming that his investment is not lost).
- Secondly, he has the option of investing the money in a portfolio of shares. His stockbroker tells him that he has a further choice of investing in high risk companies or low risk companies. If he invests in high risk companies, the potential return is 15% with a probability of 50%, but there is a probability of 30% that he will make no profit (and therefore have only his initial sum of €500,000 in one year's time), and a probability of 20% that his investment would be wiped out, with the loss of his initial sum of €500,000.
- If he invests in shares in low risk companies, the potential return is 8% with a probability of 70%, but there is a probability of 20% that he will make no profit, and a probability of 10% that his investment would be wiped out.
- Finally, he can keep his money in a safe for the year. He is confident that there is no risk of the money being lost or stolen in this case, but his money would earn no interest.
- (i). Represent this information on a decision tree, including the expected value of each node. (15 marks)
- (ii). What recommendation(s) would you make to the investor? Explain briefly. (5 marks)

Formulae:

$$\text{Mean } \mu = \frac{\sum fx}{\sum f}$$

$$\text{Standard Deviation } \sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

$$\text{Laspeyres Price Index } L_P = \frac{\sum p_n q_0}{\sum p_0 q_0} \times 100$$

$$\text{Paasche Price Index } P_P = \frac{\sum p_n q_n}{\sum p_0 q_n} \times 100$$

$$\text{Laspeyres Quantity Index } L_P = \frac{\sum p_0 q_n}{\sum p_0 q_0} \times 100$$

$$\text{Paasche Quantity Index } P_P = \frac{\sum p_n q_n}{\sum p_n q_0} \times 100$$

$$\text{Weighted arithmetic mean of price relatives index} = \frac{\sum \left(\frac{p_n}{p_0}\right) \cdot w}{\sum w} \times 100$$

Regression formulae

$$y = a + bx$$

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

$$a = \frac{\sum y - b \sum x}{n}$$

$$\begin{aligned} P(A \cap B) &= P(A)P(B|A) \\ &= P(B)P(A|B) \end{aligned}$$