UNIVERSITY OF ESWATINI

FINAL EXAMINATION PAPER 2018/2019

TITLE OF PAPER	:	BUSINESS QUANTITATIVE METHODS
COURSE CODE	:	BUS611
TIME ALLOWED	:	THREE (3) HOURS
REQUIREMENTS	:	CALCULATOR
INSTRUCTIONS	:	ANSWER ANY FOUR (4) QUESTIONS

Question 1 [25 marks, 10+3+5+7]

(a) A company manufactures two products, X and Y. Profit contribution per unit is SZL 16 for X and SZL 12 for Y. Their joint fixed costs are SZL 50 per day.

Production of the two products is restricted by limited supplies of three essential resources, A, B and C.

Each X requires 8 units of A, 4 units of B and 4 units of C whilst each Y requires 10 units of A and 8 units of B.

There are 85 units of A, 90 units of B and 25 units of C available on each day.

(i) Clearly state the optimal production plan of the two products and the total daily profit produced at this level of output.

(ii) State which resources are fully utilised at the optimal solution and show how many spare capacities in the other resources is calculated.

(b) Find a company break-even points if its cost function is $C(x) = 10x + 32$ and its revenue is $R(x) = -2x^2 + 30x$ (both in thousand of Emalangeni). Find the company maximum profit.

Question 2 [25 marks, 6+6+9+2+2]

(a) The television show *Letishisako* has a 15 share, meaning that while it is being broadcast 15% of the TV sets are tuned to *Letishisako*. A special focus group consists of 20 randomly selected households (each with one TV set in use during the time of a *Letishisako* broadcast.

(i) In such a group of 20, what is the standard deviation for the number of sets tuned to *Letishisako*?

(ii) For such a group of 20, find the probability that exactly 5 TV sets are tuned to *Letishisako*?

(b) Consider the basic food items in the following table, with their unit price and per capita annual consumption:

Food Items	Unit price (in Emalangeni) 2008	2009	Consumption 2008	2009
Milk (litres)	7.29	7.89	117	98
Bread (loaves)	4.25	4.45	56	64
Sugar (kg)	2.19	2.45	28	20
Maize meal (kg)	5.59	5.25	58	64

(i) Compute the Laspeyre's price and consumption indices and interpret them.

(ii) Which food item showed the largest price change from 2008 to 2009?

(iii) Which food item showed the largest consumption change from 2008 to 2009?

Question 3 [25 marks, 5+5+5+6+4]

(a) A business owner has to make a decision between 4 different courses of action A, B C and D. There are also 4 uncertain events (W, X, Y and Z) which may occur with differing probabilities. For each decision and uncertain event we can associate a particular financial return as indicated in the table below:

	Uncertain Event			
	W	X	Y	Z
Probability	**(0.2)**	**(0.3)**	**(0.4)**	**(0.1)**
Course of Action A	240	140	540	400
Course of Action B	420	580	0	140
Course of Action C	350	250	360	240
Course of Action D	50	120	260	500

For each of the following decision making criteria and using the information given above, state the most desirable course of action clearly giving your reasons in each case. (i) Maximax (ii) Maximin (iii) Expected Value.

(b) Find the solution to the following system of equations:

$$\begin{aligned} x_1 + x_2 + x_3 &= 3, \\ x_1 - x_2 + 2x_3 &= -3, \\ 3x_1 - x_2 + 5x_3 &= -2, \\ 2x_1 - x_2 - x_3 &= 4. \end{aligned}$$

(c) Show that the system of equations below is consistent:

$$\begin{aligned} 4x_1 + 2x_2 + 2x_3 &= 3, \\ 2x_1 + 2x_2 &= 0, \\ 2x_1 + 2x_3 &= 3. \end{aligned}$$

Question 4 [25 marks, 6+4+3+4+5+3]

A university student is about to embark upon a dissertation as part of their post graduate studies. The dissertation will be compiled of the following sections:

- Introduction
- Literature Review
- Methodology
- Findings
- Conclusions

The student has decided to produce a project planning network to represent this part of their course. They decide to break the project into the following 10 activities:

Activity		Preceding Activities	Duration(days)
A	Produce research proposal	-	7
B	Complete Literature Review	A	28
C	Supervisor meeting 1	A	1
D	Methodology	B, C	21
E	Obtain Ethics Approval	C	7
F	Data Collection	D, E	28
G	Record/Analyse Findings	F	14
H	Supervisor meeting 2	G	1
I	Make revisions	H	2
J	Write Conclusions	I	14

(a) Use the information above to draw a project planning network.

(b) Describe the two types of dummy activity which are used in project planning. Looking at the precedence table given, explain why dummy activities are required in the network you have drawn.

(c) What is the minimum number of days required to complete the dissertation?

(d) Identify which activities have floats and calculate the float in each case.

(e) Draw a gantt chart for the dissertation project.

(f) Explain why gantt charts are useful in project planning.

Question 5 [25 marks, 10+4+6+5]

(a) Ten randomly selected oil wells in a large field of oil wells produced 21, 19, 20, 22, 24, 21, 19, 22, 22, and 20 barrels of crude oil per day. Is this evidence at the 0.01 level of significance that the oil wells are not producing an average of 22.5 barrels of crude oil per day?

(b) Suppose the probability is 0.30 that any given student in a large class can provide the answer to an assigned problem. What is the probability that the fourth student randomly selected by the instructor will be the first one who can provide the answer to the problem?

(c) A test is taken by some students, their marks are recorded and we are interested in the properties of the sample mean. Under the assumption that the marks follow a Normal distribution with exact mean 60 and variance 81, calculate the probability that the mark of a randomly selected student?

(i) is greater than 59.5 exactly; and

(ii) lies between 59 and 60.5 exactly.

(d) A blended wine is intended to comprise two parts of Sauvignon to one part of Merlot. The amounts dispensed to make up a nominal 75cl bottle of this wine are X cl of Sauvignon and Y cl of Merlot, where X and Y are assumed to be independent Normally distributed random variables with respective means 52 and 26 cl and respective variances 1 and 0.5625. Find the probability that the actual volume of wine dispensed into a bottle is less than the nominal volume.

Question 6 [25 marks, 2+6+8+4+5]

(a) A bank wanted to find out whether *loan applications received* are influenced by the current loan *interest rate*. The manager selected 11 monthly periods where different interest rates applied and recorded the number of loan applications received. The data are given in the following table:

Loan applications received	
Interest rate %	**Loan applications**
7	18
6.5	22
5.5	30
6	24
8	16
8.5	18
6	28
6.5	27
7.5	20
8	17
6	21

(i) Identify the dependent variable (y) and the independent variable (x).

(ii) Compute the correlation coefficient between the *rate of interest* and number of *loan applications received*. Comment on the strength of the association.

(iii) Derive the least squares regression line between the *rate of interest* and number of *loan applications received*. Interpret the regression coefficients.

(iv) How many loan applications can the bank expect to receive when the interest rate is 6%..

(b) The following measures of location were calculated for a distribution of the number of persons per household in Mdzimba:

mode = 2 persons; mean=4.1 persons; median=3 persons

If there are 9245 households in Mdzimba, which of the following procedures is appropriate to calculate the likely total number of persons living in Mdzimba.

(i) multiply the number of households by 2

(ii) multiply the number of households by 4.1

(iii) multiply the number of households by 3.