



Together in Excellence

NKUHLU DEPARTMENT FOR ACCOUNTING STUDIES

Business Mathematics AMB 121

2nd Semester Examination

Jan-Feb 2019

Total: 150 marks

Time: 3 hours

- Write your name and student number in the appropriate spaces.
- This paper consists of 10 pages – **8 exam pages** and **ONE (1) information sheet and one (1) ANSWER SHEET**
- Answer **ALL** the questions. Number the answers correctly according to the numbering system used in this question paper
- Clearly show **ALL** calculations, diagrams, graphs, etc, which you have used to solve the problems. Where applicable, round answers to **TWO** decimal places.
- Silent Financial calculators may be used.

***PLEASE HAND BACK THE EXAMINATION PAPER
WITH YOUR SCRIPT !!!***

Examiner: N.Z Manzi

Moderator: L Funnell

BUSINESS MATHEMATICS
AMB 121
INFORMATION SHEET
Financial Mathematics

$FV = PV(1+in)$		
$1 + i_{eff} = \left(1 + \frac{i}{n}\right)^n$	$FV = PV(1+i)^n$	$i = \left(\frac{FV}{PV}\right)^{\frac{1}{n}} - 1$
$FV_A = \frac{PMT[(1+i)^n - 1]}{i}$	$PV_A = \frac{PMT[1 - (1+i)^{-n}]}{i}$	$PV_{AP} = \frac{PMT}{i}$
$FV_{AD} = \frac{PMT[(1+i)^n - 1]}{i}(1+i)$	$PV_{AD} = \frac{PMT[1 - (1+i)^{-n}]}{i}(1+i)$	
$FV = PV(1-in)$	$FV = PV(1-i)^n$	$i = 1 - \left(\frac{FV}{PV}\right)^{\frac{1}{n}}$

Linear & quadratic functions

$y = mx + c$	$y = ax^2 + bx + c$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	$x = \frac{-b}{2a}$
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Probability

$P(E) = \frac{n(E)}{n(S)}$	$P(A') = 1 - P(A)$
$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$	$P(A \text{ or } B) = P(A) + P(B)$ - mutually exclusive
$P(A \text{ and } B) = P(A) \times P(B)$	$P(A \text{ and } B) = 0$ - mutually exclusive

Regression & correlation

$\text{correlation coefficient } (r) = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$		
$\hat{y} = a + bx$	$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$	$a = \bar{y} - b\bar{x}$

QUESTION 1**45 marks (54min)**

Four possible options are provided as answers to the following questions. Each question has only **ONE** correct answer. Choose the correct answer and write (A – D) next to the question number.

- 1.1 Interest paid on only the original principal borrowed is often known as ...
A. Nominal interest
B. Simple interest
C. Effective interest
D. Compound interest
- 1.2 How long would it take R800 to double in value if the interest rate were 4,2% per compounded annually?
A. 16,8 years
B. 14,6 years
C. 12,4 years
D. 15,8 years
- 1.3 If 15% interest is compounded quarterly then the annual compounded rate is
A. 14,31%
B. 15,87%
C. 15,76 %
D. 14,22%
- 1.4 Nathi is going to receive R10 000 five years from now. Tammy is going to receive R10 000 eight years from now. Which one of the following statements is correct if both Tammy and Jeff apply a 6 % p.a. discount rate to these amounts?

A. The value of Nathi 's money is less than that of Tammy's money 15 years from now.
B. Ten years from now, the value of Nathi 's money is to the value of Tammy's money.
C. In today's dollars, Nathi 's money is worth more than Tammy's.
D. Tammy's money is more than Nathi 's money, given the 6 % p.a. discount rate.
- 1.5 A machine is to be replaced after 5 years, when it is expected to cost R1 000 000. What equal amount should be set aside and invested, at the end of each year at 12% p.a. to accumulate the desired sum?
A. R162 416
B. R157 410
C. R175 115
D. R153 429
- 1.6 A loan stock with a maturity of 10 years pays an annual interest of R10. If you want to earn 11 percent on this investment, what is the maximum amount you should pay to purchase one share of this loan stock today?

A. R50,82
B. R119,50
C. R58,89
D. R72,00

- 1.7 A single letter is selected from the word PROBABILITY. The probability that it is a vowel is ...
- A. $\frac{3}{11}$
 - B. $\frac{2}{11}$
 - C. $\frac{4}{11}$
 - D. $\frac{7}{11}$
- 1.8 If $P(A) = P(B)$, $P(A \text{ or } B) = 0,7$ and $P(A \text{ and } B) = 0,1$ then the value of $P(\text{not } A)$ equals
- A. 0,3
 - B. 0,4
 - C. 0,6
 - D. 0,7
- 1.9 If \hat{y} is the predicted value for a given x -value and b is the y -intercept then the equation of a regression line for an independent variable x and a dependent variable y is
- A. $\hat{y} = mx + b$, where $m = \text{slope}$.
 - B. $x = \hat{y} + mb$, where $m = \text{slope}$.
 - C. $\hat{y} = \frac{x}{m} + b$, where $m = \text{slope}$.
 - D. $\hat{y} = x + mb$, where $m = \text{slope}$.
- 1.10 XYZ Inc. produces two types of paper towels, called *regular* and *super*. Regular uses 2 units of recycled paper per unit of production and super uses 3 units of recycled paper per unit of production. The total amount of recycled paper available per month is 10 000. Letting x be the number of units of regular produced per month and y represent the number of units of super-soaker produced per month, the appropriate constraint/s will be
- A. $2x + 3y = 10000$
 - B. $2x + 3y \geq 10000$
 - C. $2x + 3y \leq 10000$
 - D. $2x = 3y$
- 1.11 Which of the following can NOT be answered from a regression equation?
- A. Predict the value of y at a particular value of x .
 - B. Estimate the slope between y and x .
 - C. Estimate whether the linear association is positive or negative.
 - D. Estimate whether the association is linear or non-linear
- 1.12 For the number of products x and y , which of the following could be a linear programming objective function?
- A. $C = xy + 2$
 - B. $C = x^2 + 2y$
 - C. $C = x + 2y$
 - D. $C = y + 2/x$

- 1.13 Consider a linear programming problem in which the objective function $A = -2x + 3y$. If the vertices of the feasible area are $\{(1; 2); (2; 3); (6; 5); (4; 5)\}$, which vertex minimizes the objective function?
- $(4; 5)$
 - $(6; 5)$
 - $(1; 2)$
 - $(2; 3)$
- 1.14 Contribution margin percentage is 30% and selling price is R5 000 then contribution margin per unit will be
- R900
 - R1 200
 - R1 500
 - R1 600
- 1.15 With respect to fixed costs, CVP analysis assumes total fixed costs ...
- per unit remains constant as volume changes.
 - remains constant from one period to the next.
 - varies directly with volume.
 - remains constant across changes in volume.

[15 x 3 = 45]

QUESTION 2**28 marks (34min)**

- 2.1 Two friends each receive an amount of R6 000 to invest for a period of 5 years. They invest the money as follows:
- Radesh: 8,5% per annum simple interest. At the end of the 5 years, Radesh will receive a bonus of exactly 5% of the principal amount.
 - Thandi: 8% per annum compounded quarterly.
- Who will have the bigger investment after 5 years? Justify your answer with appropriate calculations. (9)
- 2.2 You wish to buy your first home. Your **gross** salary is R 8 250 per month and you have deductions of 25 % per month from your salary. The bank will only allow bond repayments that are not greater than 30 % of your **net** monthly salary.
- 2.2.1 What is your net salary? (1)
- 2.2.2 What is the maximum bond repayment you can afford? (1)
- 2.2.3 The bank offers a fixed bond rate of 13,5% per annum compounded monthly, over a 20 year period. A flat that you would like to buy costs R 150 000. Can you afford the flat? (Show all working) (5)
- 2.3.1 What is the value of 24 equal monthly payments that will repay a loan of R25 000 if payments begin immediately after the granting of the loan at 15% p.a. compounded monthly? (4)

2.3.2 What is the balance outstanding after the 10th monthly payment? (4)

2.4 Petros Zulu wants R340 000 in 5 years time to purchase a VW Caravan. He opens a savings account and deposits R10 000. He then decides to invest an equal annually amount at the end of *each year* at an interest rate of 8% p.a compounded *every two months*. What amount must he invest each year to achieve his goal? (4)

QUESTION 3

25 marks (30min)

3.1



A farmer has just bought a new tractor for R800 000. He has decided to replace the tractor in 5 years' time, when its trade-in value will be R200 000. The replacement cost of the tractor is expected to increase by 8% per annum.

3.1.1 The farmer wants to replace his present tractor with a new one in 5 years' time. The farmer wants to pay cash for the new tractor, after trading in his present tractor for R200 000. How much will he need to pay? (5)

3.1.2 One month after purchasing his present tractor, the farmer deposited x rands into an account that pays interest at a rate of 12% p.a., compounded monthly. He continued to deposit the same amount at the end of each month for a total of 60 months. At the end of sixty months he has exactly the amount that is needed to purchase a new tractor, after he trades in his present tractor. Calculate the value of x . (4)

3.2 R1 430,77 was invested in a fund paying i % p.a. compounded monthly. After 18 months the fund had a value of R1 711,41. Calculate i (4)

3.3 The Hayne's Company takes a *full year's* depreciation expense a year after the acquisition of an asset. The following information is given on the depreciable asset:

Acquisition date	: 01/01/1999
Useful life	: 5 years
Salvage value	: R20 000
Cost	: R110 000
Accumulated depreciation as of 31/12/1999: R30 000	

3.3.1 Calculate the depreciation of the asset for *each* of three methods of depreciation i.e. straight-line, reducing balance and sum-of-digits (SYD). Now write down which depreciation method Hayne's used for 1999. (10)

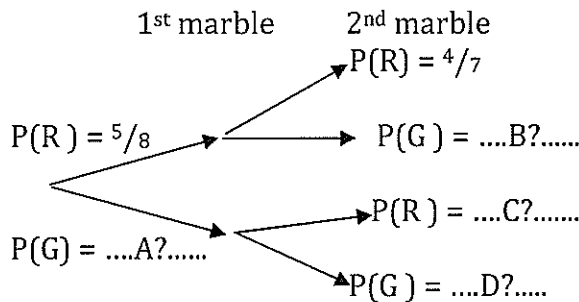
3.3.2 Assuming that the company uses the same depreciation methods as in 1999, what would be the depreciation amount for 2000? (2)

QUESTION 4 **30 marks (36min)**

4.1 Each of the 200 employees of a company wrote a competency test. The results are indicated in the table below:

	Pass	Fail	Total
Female	72	50	122
Male	46	32	78
Total	118	82	200

- 4.1.1 Are the events PASS and FAIL mutually exclusive? Explain your answer. (2)
- 4.1.2 Is passing the competency test independent of gender? Substantiate your answer with the necessary calculations. (3)
- 4.2 There are only red marbles and green marbles in a bag. There are 5 red marbles and 3 green marbles. Dwayne takes at random a marble from the bag. He does not put the marble back in the bag. Dwayne takes at random a second marble from the bag.



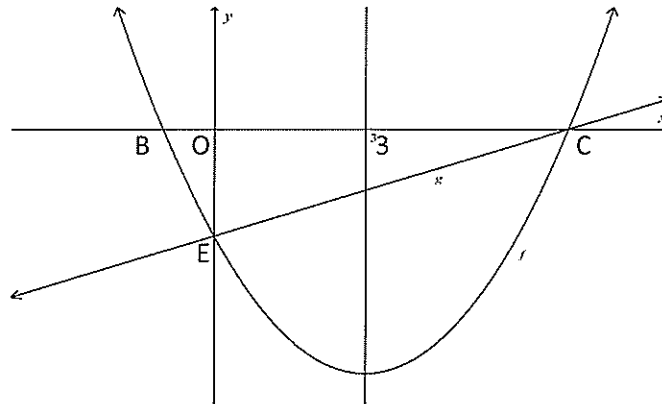
- 4.2.1 Complete the probability tree diagram. (2)
- 4.2.2 Determine the probability that Dwayne takes marbles of different colours. (3)

4.3 Complaints about a restaurant fell into three main categories: the menu (M), the food (F) and the service (S). In total 173 complaints were received in a certain month. The complaints were as follows:

- 110 complained about the menu.*
- 55 complained about the food.*
- 67 complained about the service.*
- 20 complained about the menu and the food, but not the service.*
- 11 complained about the menu and the service, but not the food.*
- 16 complained about the food and the service, but not the menu.*
- The number who complained about all three is unknown.*

- 4.3.1 Draw a Venn diagram to illustrate the above information. (7)
- 4.3.2 Determine the number of people who complained about ALL THREE categories. (3)
- 4.3.3 Determine the probability that a complaint selected at random from those received, complained about AT LEAST TWO of the categories (that is. menu, food and service). (2)

4.4 A parabola f intersects the x -axis at B and C and the y -axis at E . The axis of symmetry of the parabola has the equation $x = 3$. The line through E and C is $g(x) = \frac{x}{2} - \frac{7}{2}$.



4.4.1 Show that the co-ordinates of C are $(7 ; 0)$ (1)

4.4.2 Calculate the x -value of B (1)

4.4.3 Determine the equation of the parabola, f (6)

QUESTION 5

22 marks (26min)

5.1 A training manager wants to know if there is a link between the hours in training (x) spent by a particular category of employee and their productivity (units produced per day, y) on the job. The data below was extracted from the files of 10 employees.

Hours in training (x)	16	36	20	38	40	30	35	22	40	24
Productivity(units produced per day) (y)	45	70	44	56	60	48	75	60	63	38

5.1.1 Determine the equation of the least squares line for this data. (3)

5.1.2 Determine coefficient of determination for the data. (2)

5.1.3 Estimate the productivity level for a particular employee who has received only 22 hours of training. (2)

5.2 Amina owns a small factory that manufactures two types of cellular phones, namely Acuna and Matata cellular phones.

Each Acuna cellular phone requires 10 man-hours to manufacture and each Matata cellular phone requires 8 man-hours to manufacture.

Each Acuna cellular phone requires 3 man-hours in the testing department and each Matata cellular phone requires 4 man-hours in the testing department.

The manufacturing department has a maximum of 800 man-hours available per week.

The testing department has a maximum of 360 man-hours available per week.

The factory needs to manufacture at least 60 of the Matata models each week.

Let x represent the number of Acuna cellular phones manufactured in one week.

Let y represent the number of Matata cellular phones manufactured in one week.

- 5.2.1 Find the inequalities and then sketch a graph of the feasible region using the **attached sheet**. (6)
- 5.2.2 If the profit on one Acuna cellular phone is R200 and the profit on one Matata cellular phone is R250, write down the objective function that will represent the profit, P, on the cellular phones. (1)
- 5.3 Scoot-Scoot is considering the production and sale of plastic scooters for kids. Annual fixed costs associated with the project are expected to total R3 00 000. In addition, each scooter would sell for R 250 and would require R 150 in variable costs.
- 5.3.1 Calculate the breakeven point in units. (3)
- 5.3.2 Calculate the breakeven point in rand. (2)
- 5.3.3 Calculate the operating income or loss at a sales volume of 5 000 scooters. (3)
- [22]

(INSERT THIS SHEET INTO YOUR ANSWER BOOK)

NAME:

STUDENT NUMBER:

5.2.1

**Matata
Phones**

