



The Co-operative University of Kenya

END OF SEMESTER EXAMINATIONS

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN FINANCE, BACHELOR OF COOPERATIVE BUSINESS AND BACHELOR OF COOPERATIVES AND COMMUNITY DEVELOPMENT

COURSE CODE: **BMAT 1104**

UNIT TITLE: **MANAGEMENT MATHEMATICS I**

DATE: **DECEMBER, 2019**

Time: **2 Hours**

INSTRUCTIONS

1. Answer question **ONE** and any other **TWO (2)** questions
3. Scientific Calculators and non-programmable calculators may be used
4. Use the provided statistical tables where applicable

1. (a) Define the following terms as used in management mathematics
 - i. Set (1 mark)
 - ii. Singleton set (1 mark)
 - iii. Investment appraisals (1 mark)
- (b) Simplify
 $\log_2\left(\frac{8}{7}\right) + \log_2\left(\frac{3}{2}\right) - \log_2\left(\frac{3}{14}\right)$ (3 marks)
- (c) The 3rd and 6th terms of G.P are 5 and -40 respectively. Find the 8th term of this sequence (7 marks)
- (d) Solve the system by substitution method (4 marks)

$$\begin{aligned} x + 3y &= 4 \\ 2x + 5y &= 7 \end{aligned}$$
- (e) Solve and draw the solution graph for the following inequality (5 marks)

$$2x < x - 4 \leq 3x + 8$$
- (f) Define the following terms Future value, Present value , Annuity and Perpetuity (5 marks)
- (g) Differentiate between set union and set intersection (3 marks)
2. (a) Let A and B be two finite sets such that $n(A) = 20$, $n(B) = 28$ and $n(A \cup B) = 36$, find $n(A \cap B)$ (4 marks)
- (b) Mrs. B invested \$30,000; part at 5% and part as 8%. The total interest on the investment was \$2,100. How much did she invest at each rate? (8 marks)
- (c) An investor deposits \$10,000. Ten years later it is worth \$17,910. What rate of return did the investor earn on the investment? (5 marks)
- (d) What is the present value of a 4-year annuity, if the annual interest is 5%, and the annual payment is \$1,000? (3 marks)

3. (a) PL produces and sells two products. The M sells for \$7 per unit and has a total variable cost of \$2.94 per unit, while the N sells for \$15 per unit and has a total variable cost of \$4.5 per unit. The marketing department has estimated that for every five units of M sold, one unit of N will be sold. The organizations fixed costs total \$36,000. Calculate.
- i. Contribution per unit (4 marks)
 - ii. Contribution per mix (2 marks)
 - iii. The breakeven point in terms of the number of mixes (2 marks)
 - iv. The breakeven point in terms of the number of units of products (3 marks)
 - v. The breakeven point in terms of revenue (4 marks)
- (b) Use a Venn Diagram to represent the following information
 $U = 1, 2, 3, 4, 5, 6, 7$
 $A = 2, 4, 6, 5$ and $B = 1, 2, 3, 5$, then $A \cap B = 2, 5$ (5 marks)
4. (a) The demand and Supply function are given as follows
 $Q_d = 22 - 2p + 0.5Y$
 $Q_s = 15 + 4p - 2CI$
 where Y = income and CI = cost of inputs. Calculate the equilibrium price and quantity where $Y = 30$ and $CI = 10$ (10 marks)
- (b) What do you understand by the term Cost-volume profit (*CVP*) analysis (2 marks)
- (c) Differentiate between the following terms
- i. Non-operating revenues and Non-operating expenses (4 marks)
 - ii. Cost of goods sold and Operating Costs (4 marks)

Solutions to Exam

1(a)i.

A set in mathematics is a collection of well defined and distinct objects, considered as an object in its own right

1(a)ii. Singleton set is a set with one element in it.

1(a)iii. Investment appraisal is a collection of techniques used to identify the attractiveness of an investment.

1b.

$$\log_2 = \frac{\frac{8}{7} \times \frac{3}{2}}{\frac{3}{14}}$$

$$\log_2[8]$$

$$\log_2[2^3]$$

$$= \frac{3\log 2}{\log 2}$$

1c. $a_n = ar^{n-1}$

$$a_3 = ar^2 = 5$$

$$a_6 = ar^5 = -40$$

Next

$$\frac{ar^5}{ar^2} = \frac{-40}{5} = r^3 = -8$$

$$r = \sqrt[3]{-8} = -2$$

Now, $s(-2)^2 = 5; a = \frac{5}{4}$

$$a_8 = ar^7 = \frac{5}{4}(-2)^7 = -160$$

1d. From first equation;

$$x = 4 - 3y$$

substituting

$$2(4 - 3y) + 5y = 7$$

$$8 - 6y + 5y = 7$$

$$-y = -1$$

$$y = 1$$

Next

$$x = 4 - 3y$$

$$= 4 - (3 \times 1) = 1$$

1e. $2x < x - 4$

$$x < -4$$

$$x - 4 \leq 3x + 8 \quad -2x \leq 12; x \geq -6$$

graph

1f. Present value is defined as the current worth of the future cash flow whereas Future value is the value of the future cash flow after a certain time period in the future. The only difference between annuity and perpetuity is the ending period. For annuity, payments last for a certain period, whereas for perpetuity, they continue indefinitely.

1g. The union of two sets is a new set that contains all of the elements that are in at least one of the two sets and The intersection of two sets is a new set that contains all of the elements that are in both sets

$$\begin{aligned} 2a. \quad n(A \cap B) &= n(A) \times n(B) - n(A \cup B) \\ &= 20 \times 28 - 36 \\ n(A \cap B) &= 524 \end{aligned}$$

2b. Forming linear equations

$$x + y = 30,000$$

$$0.05x + 0.08y = 2,100$$

making the second equation with whole numbers

$$5x + 8y = 2,100$$

Using first equation and third equation

$$x + y = 30,000$$

$$5x + 8y = 2,100$$

$$5x + 5y = 150,000$$

$$5x + 8y = 210,000$$

$$= -3y = -60,000; y = 20,000$$

$$\text{From equation one } x = 30,000 - 20,000 = 10,000$$

The investment was

\$10,000 and \$20,000 respectively

$$2c. \quad A = P(1 + \frac{r}{100})^t$$

$$17,910 = 10,000(1 + \frac{r}{100})^{10}$$

$$(1 + \frac{r}{100})^{10} = 1.791$$

$$1 + \frac{r}{100} = \sqrt[10]{1.791}$$

$$\frac{r}{100} = \sqrt[10]{1.791} - 1; r = [\sqrt[10]{1.791} - 1] \times 100$$

$$2d. \quad FV_{\text{Ordinary annuity}} = \$1000 \times [\frac{(1+0.05)^5}{0.05}]$$

$$= 1000 \times 5.53$$

$$= \$5525.63$$

3(a)i.

We have two major M and N

M : \$perunit;

Selling price: 7.00

Variable cost: 2.94

Contribution: 4.06

N : \$perunit;

Selling price: 15.00

Variable cost: 4.50

Contribution: 10.50

3(a)ii.

$$= \$4.06x5 + \$10.50x1 = \$30.80$$

3(a)iii.

$$= \text{fixed costs} / \text{contribution per mix} = \frac{\$36,000}{\$30.80}$$

$$= 1,169 \text{ mixes (rounded)}$$

3(a)iv. $= (1,169 \times 5) 5,845$ units of M and $(1,169 \times 1) 1,169$ units of N

3(a)v. $= (5,845 \times \$7) + (1,169 \times \$15)$
 $= \$40,915$ of M and $\$17,535$ of N
 $= \$58,450$ in total

3b. Well represented Venn Diagram

4b. Cost-volume-profit (*CVP*) analysis is a method of cost accounting that looks at the impact that varying levels of costs and volume have on operating profit.

4(c)i.

Some business expenditures are incurred for reasons that don't involve normal business operations. For instance, the costs of relocating your business falls outside core business operations and would be recorded as a non-operating expense while Non-operating revenues are the amounts earned by a business which are outside of its main or central operations.

4(c)ii.

COGS includes direct labor, direct materials or raw materials, and overhead costs for the production facility. Cost of goods sold is typically listed as a separate line item on the income statement. Operating expenses are the remaining costs that are not included in COGS