The University of Zambia
Department of Mathematics & Statistics
MAT1110: Foundation Mathematics & Statistics for social sciences
Test 1 (27-03-2021)

Time Allowed: **2 hours**.

Instructions: **Attempt all questions**.

Show all **necessary working** to earn full marks.

Calculators are not allowed

Indicate your **names**, **TG** number and **Computer number** on each answer sheet submitted

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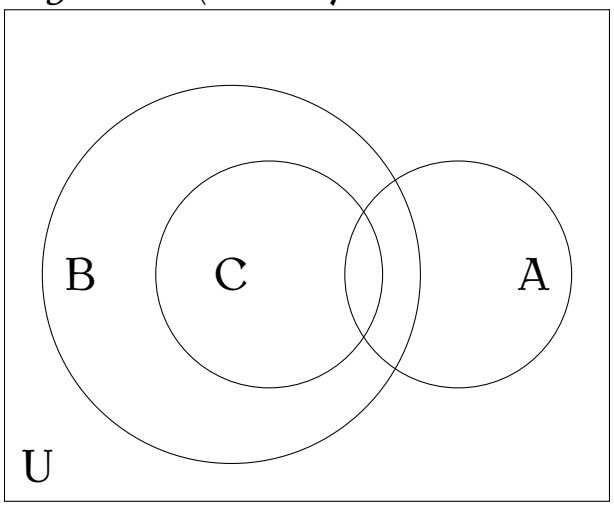
1. (a) Define each of the following.
   i. Set.
   ii. Universal set.
   iii. Complement of a set A.

   [6 marks]

   (b) i. Let $X = \mathbb{R}$ be the universal set, $A = (-1, 1]$, $B = (2, 4)$ and $C = [1, 3]$.
   Find the set
   $$(A - B) \cap (X \cap C^c)^c,$$
   and display the solution on the line. [6 marks]

   ii. Let U be the universal set, A and B subsets of U. If A is a complement of B, express
   $$[(A^c \cup B^c) \cap (A \cap B)]^c$$
   in simplest form. [3 marks]

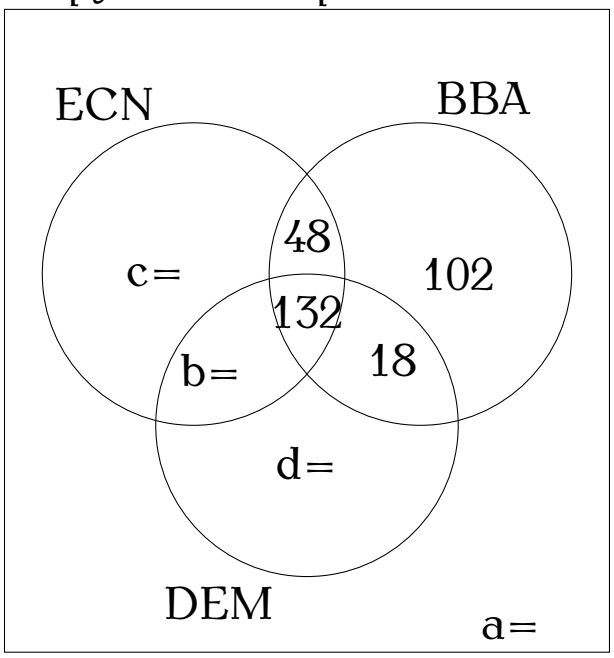
(c) i. Copy the Venn diagram below and shade the region representing $A^c - (B \cap C)$.



[3 marks]

ii. For the purposes of allocating first year students to different MAT 1110 lecture groups, a survey was randomly conducted on 600 students in the school of Humanities and Social Sciences of the University of Zambia. The results showed that:
60% took ECN 1115, 50% took BBA 1110, 45% took DEM 1110. In addition, 30% to ECN 1115 and BBA 1110, 28% took ECN 1115 and DEM 1110 and 25% took BBA 1110 and DEM 1110. 6% of the students took non of the these three courses.

Copy and complete the Venn diagram below.



[8 marks]

2. (a) Express each of the following in the form $\frac{a}{b}$, so that a and b have not common factors.

i. 0.125 [2 marks]

ii. $0.291\overline{6}$ [4 marks]

(b) i. Simplify

$$\sqrt{20} + \sqrt{80} - \sqrt{180}.$$ [3 marks]

ii. Find the value of a and of b given that

$$\frac{1+\sqrt{2}}{-2+\sqrt{5}} - (\sqrt{5} + \sqrt{10}) = a + \sqrt{b},$$

where $a, b \in \mathbb{Z}$. [4 marks]

(c) Find the value of x and of y if

$$\frac{2+8i}{1-i} = x + xi + y + y\,i^3.$$ [6 marks]

3. (a) Define each of the following.

i. Function.

ii. Even function.

iii. Odd function.

[6 marks]

(b) i. Given that $g(x) = \frac{x^2-x}{x+1}$. Determine whether g is even, odd or neither odd nor even. [3 marks]

ii. Let $f(x) = -1 + \sqrt{x-1}$. Find the **domain** and **range** of f. [3 marks]

(c) Given that $f(x) = \frac{2x+1}{3x+2}$, $g(x) = x - 3$,

i. find $(gof)(x)$ in its simplest form [2 marks]

ii. find the value of x for which $f^{-1}(x) = 2$. [4 marks]