



PANIPIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science ; Bachelor of science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BSAM; 07BOSC	LEVEL: 5
COURSE CODE: MAS501S	COURSE NAME: MATHEMATICAL STRUCTURES
SESSION: JULY 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 95

SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER	Mr B.E OBABUEKI
MODERATOR:	Prof S.A REJU

INSTRUCTIONS
<ol style="list-style-type: none">1. Answer ALL the questions in the booklet provided.2. Show clearly all the steps used in the calculations where necessary.3. All written work must be done in blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

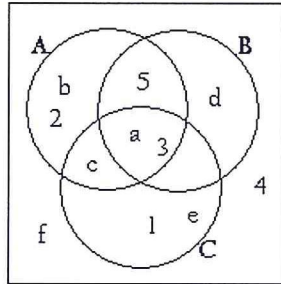
THIS QUESTION PAPER CONSISTS OF 5 PAGES (excluding this front page)

Question 1 (15 marks)

- 1.1 Determine the sum $3233.32_4 + 2013_4 + 2233.02_4 + 20232.23_4$ (4)
1.2 Perform the subtraction $52002.22_6 - 35532.234_6$ (4)
1.3 What is $FE.8_{16} - 223.4_8$?. Give your final answer in base 5. (7)

Question 2 (23 marks)

- 2.1 Consider the Venn diagram:



List the elements of:

- 2.1.1 $A \cup B$ (3)
2.1.2 $B \cap C$ (2)
2.1.3 $(A \cap B \cap C)'$ (3)
- 2.2 A set of students were asked to tell which sports they played in school.

The options are Football, Hockey, Basketball and Netball.

Here is the list of the results:

Sport	Names
Football	Robert, James, John, Mary, Jennifer, William
Hockey	Robert, William, Linda, Elizabeth, James
Basketball	William, Jayne, Linda, Daniel, Mary
Netball	Jessica, William, Linda, Elizabeth, Anthony, Marv
None	Dorothy

Draw a Venn diagram to show the data sets we have. (Use the attached sheet named “Venn diagram”. Insert this sheet in your answer booklet.) (9)

<https://www.intellspot.com/venn-diagram-examples/>

2.3 Given that A and B are subsets of the same universal set, prove that $A \cap B' \subseteq (A' \cup B)'$. (6)

Question 3 (11 marks)

3.1 Consider the following statements:

- p: Peter went to school
- q: Queen ate an apple
- r: Russel missed his soccer practice
- a: Agnes cried.

Write the statement ***Peter went to school and Queen did not eat an apple, because Russel missed his soccer practice and Agnes did not cry*** in symbolic logic. (6)

3.2 Use the following truth table to determine whether the two statements $(p' \vee q) \Rightarrow r$ and $r' \Rightarrow (p \wedge q')$ are contradictions, a tautology, equivalent or none of these. (5)

p	q	r	$\neg p \vee q$	$(\neg p \vee q) \Rightarrow r$	$p \wedge \neg q$	$\neg r \rightarrow (p \wedge \neg q)$
T	T	T				
T	T	F				
T	F	T				
T	F	F				
F	T	T				
F	T	F				
F	F	T				
F	F	F	T	F	F	F

Question 4 (16 marks)

4.1 Draw a flowchart that reads the gender and ages of 1000 persons and outputs the average age of the females. (10)

- 4.2 The following pseudocode is to read 500 numbers, identifies only the odd numbers, counts how many odd numbers are read, and outputs the number of odd numbers and their average. Write down what the letters A, B, C, D, E, and F each represents in the pseudocode. (6)

Start

Int **A**, count = 0

Float average, sum = 0, num(n)

B n <= 500

 Read **C**

 If num(n) = odd

 sum = sum + **D**

 count = count + 1

 Endif

 n = **E**

Enddo

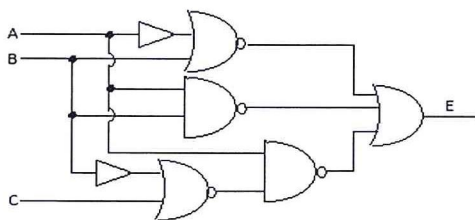
average = sum/**F**

Print average

End

Question 5 (16 marks)

- 5.1 Draw the logic circuit for the Boolean expression $E(X, Y, Z) = \overline{\overline{X + Y}Z + \overline{X}YZ + \overline{\overline{X + Y}}}$. (6)
- 5.2 Express $\overline{AB} + \overline{A + BC} + \overline{A + BC} + \overline{B}$ in a sum of products form. (6)
- 5.3 Copy the table below and use the following logic circuit to complete it. (4)



A	B	C	E
0	1	0	
1	0	1	
1	1	0	
0	0	1	

Question 6 (14 marks)

6.1 Use mathematical induction to prove that the sum of the first n natural numbers is $\frac{n^2 + n}{2}$. (8)

6.2 Prove that the product xy is even given that x is odd and y is even. (6)

END OF QUESTION PAPER. Total marks: 95, convertible to 100%

Use attached sheet as instructed.

Venn Diagram for question 2.2

