



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY
FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES**

SCHOOL OF NATURAL AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

QUALIFICATION: Bachelor of science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BSAM	LEVEL: 5
COURSE CODE: MAS501S	COURSE NAME: MATHEMATICAL STRUCTURES
SESSION: JUNE 2023	PAPER: THEORY
DURATION: 180 MINUTES	MARKS: 100

FIRST OPPORTUNITY QUESTION PAPER	
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MODERATOR:	PROFESSOR SUNDAY REJU

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

PERMISSIBLE MATERIALS

Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 3 PAGES (excluding this front page)

Question 1 (21 marks)

1.1 Do the following sums

1.1.1 $2132.224_5 + 214.024_5 + 4432.422_5 + 21212.244_5$ (4)

1.1.2 $6601.236_7 - 5535.2645_7$ (4)

1.2 Do the following conversions

1.2.1 $AB8.FE_{16}$ to decimal (6)

1.2.2 527.56_{10} to octal correct to 3 octal places. (7)

Question 2 (15 marks)2.1 Given that A , B , and C are subsets of a universal set S , draw a Venn diagram and shade the subset $(A \cup B) \cap C'$. (2)2.2 Prove that $P' \cap Q'$ is a subset of $(P \cup Q)'$ given that P and Q are subsets of Z . (6)

2.3 A survey of 100 youths gave the following information:

50 jog, 30 swim, and 35 cycle; 14 jog and swim; 7 swim and cycle; 9 jog and cycle; 3 take part in all three activities.

2.3.1 Represent the given information in a Venn diagram. (4)

2.3.2 How many youths jog but do not swim or cycle? (1)

2.3.3 How many youths take part in only one of the three activities? (1)

2.3.4 How many youths do not take part in any of the three activities? (1)

Question 3 (12 marks)3.1 Copy and complete the following truth table in your answer script: (\neg means negation) (5)

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

- 3.2 *If Jane does not cry or Paul works hard then, dad gets his salary and ma does not sell her car.*

Use the following variables to express the statement above in symbolic logic form:

(5)

j: Jane will cry; p: Paul will work hard;

d: dad got his salary; m: ma sold her car

- 3.3 Write down the contra-positive version of the statement: If Peter plays soccer, then Mary plays netball. (2)

Question 4 (17 marks)

- 4.1 The following pseudocode is expected to read 1000 whole numbers and output the average of only the even numbers.

START

INT n = 0, num(n), sum = 0, k = 1000, count = 0

FLOAT average

BINARY even, odd, fraction

DOWHILE n <= 100

 READ num(1)

 IF num(n) = even

 sum = sum + num(n)

 count = count + 1

 ELSE

 ENDIF

ENDWHILE

average = sum/count

PRINT 'The average is' AVERAGE

END

There are errors in this pseudocode. Rewrite the pseudocode with the errors corrected. (5)

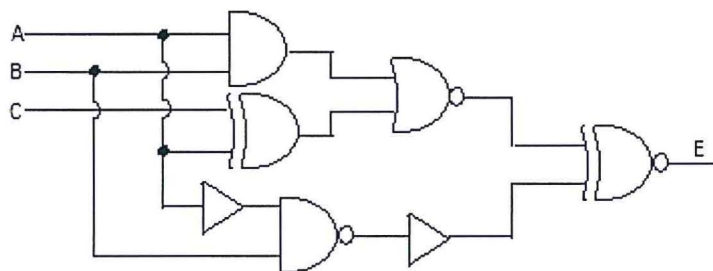
- 4.2 Draw a flowchart that reads 1000 numbers and outputs the average of only the numbers not less than 25. (12)

Question 5 (20 marks)

- 5.1 Draw the logic circuit of the Boolean expression $E(A, B, C) = \overline{\overline{A}B} + \overline{\overline{A}BC} + (\overline{A+B})C$. (7)

- 5.2 Simplify the Boolean expression $B(x, y, z) = \overline{\overline{x}y} + \overline{\overline{x}y + z} + x(\overline{yz})$. (5)

- 5.3 Study the following logic circuit:



Draw the following table in your answer script and use the logic circuit to complete it. (8)

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

Question 6 (15 marks)

- 6.1 Prove that the sum of two even numbers is even. (6)

- 6.2 Use mathematical induction to prove that the sum of the first n natural numbers is $\frac{n}{2}(n+1)$. (9)

END OF PAPER

TOTAL: 100 MARKS