Faculty of Information and Communication Technology
ICT First Years and Foundation Unit

Tshwane University of Technology
We empower people

FORMATIVE ASSESSMENT 3
(MEMO)
Computational Mathematics and Discrete Mathematics
(Extended) (Year 1)

COHF05D & DSMF06D

I declare that I am familiar with, and will abide to the Examination rules of Tshwane University of Technology

November 2022

Duration: 120 min
Total: 81
Full Marks: 80
Number of Pages: 13

Examiner: MS Sediela
Moderator: C Coetzee

Number on Class List

GROUP

Student Number

Surname

Initials

Signature

Instructions:

All questions must be answers on the question paper.

Only blue and black pens are allowed. Answers in pencil will not be marked.

Scientific, non-programmable calculators are allowed.

Cellular Phones are not allowed.

No sharing of calculators and/or stationary.

Round decimal answers to 2 decimal places.

Simplify fraction answers.

Show all calculations when requested.

Question 1 [35]

1.1 Given the following sets in descriptive, write the equivalent Set Builder notation and the Roster Method: (2)

Descriptive Method	Set Builder Notation	Enumeration Method (Roster Method)
A set of whole number less than 5.	$\{x \mid x < 5, x \in \mathbb{N}_0\}$ ✓	$\{0, 1, 2, 3, 4\}$ ✓
A set of positive even numbers less than 10.	$\{2x \mid x < 5, x \in \mathbb{N}\}$ ✓	$\{2, 4, 6, 8\}$ ✓

1.2 Given the following set: (4)

$$A = \{a, e, i, o\ u\}$$

State whether the following statements are true or false:

Statements	True	False
$\{u, o, i, e, a\} \subseteq A$	X ✓	
$\{u, o, i, e, a\} \subset A$		X ✓
$\{\} \supset A$		X ✓
$\{\} \subseteq A$	X ✓	

1.3 Given set C = { Lion, Tiger, Leopard }. Answer the following question about the subsets of set C. (4)

	Question	Answer	
1.3.1	How many subsets of set C have zero elements (Empty subsets of set C)?	1 ✓	(1)
1.3.2	How many subsets of set C have one element (singleton subsets of set C)?	3 ✓	(1)
1.3.3	How many subsets of set C have two elements?	3 ✓	(1)
1.3.4	How many subsets of set C have three elements?	1 ✓	(1)

1.4 Simphiwe own a spaza shop and sells Sphatlho to students. (6)

There are two sauces available for the Sphatlho: Tomato Sauce and Mustard Sauce.

$$\boldsymbol{Let\ S = \{Tomato\ , Mustard\}}$$

Answer the following questions:

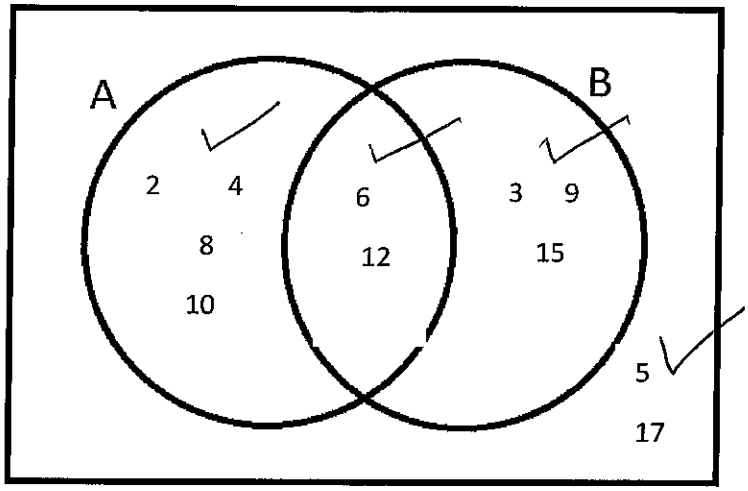
Question		Answer	
1.4.1	n(S) =	2 ✓	(1)
1.4.2	n(P(S))=	4 ✓	(1)

1.4.3 Use a binary table to determine all possible subsets of set S. (4)

Decimal Numbers	Binary Numbers		Subsets
	Tomato	Mustard	
0	0	0	{ } ✓
1	0	1	{Mustard} ✓
2	1	0	{Tomato} ✓
3	1	1	{Tomato, Mustard} ✓

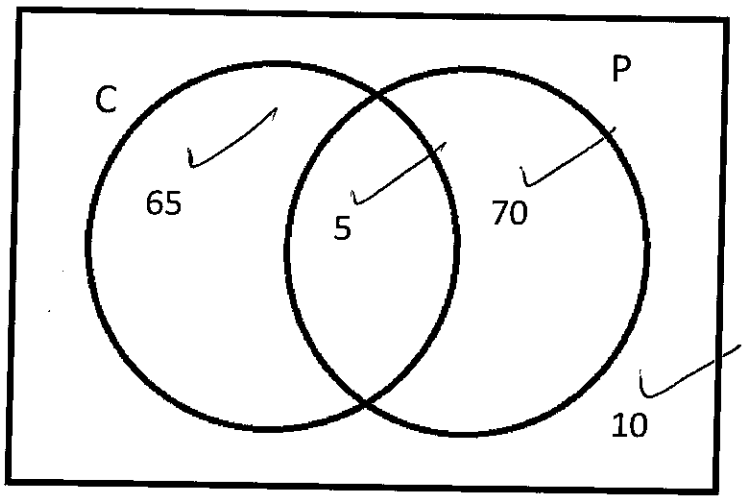
1 mark per correct row!!

1.5	Consider the following sets: $A = \{2, 4, 6, 8, 10, 12\}, \quad B = \{3, 6, 9, 12, 15\},$ $\mathcal{U} = \{2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 17\}$ List the following sets in the correct sector of the given Venn Diagrams:	(8)

1.5.1		(4)
1.5.2	$B - A = \{3, 9, 15\}$	(1)
1.5.3	$A - B = \{2, 4, 8, 10\}$	(1)
1.5.4	$A \cap B = \{6, 12\}$	(1)
1.5.5	$\overline{A \cup B} = \{5, 17\}$	(1)

1.6	The ICT 1st Years and Foundation Unit hosted competitions in the subjects that they offer. 150 students participated in the competitions. • 70 students participated in COHF05D competition, • 75 students participated in PPAF05D competition, • 10 students neither participated in COHF05D or PPAF05D competition. Let **C** be the set of students who participated in **COHF05D** competition. Let **P** be the set of students who participated in **PPAF05D** competition. **Answer the following questions (Show all steps):**	(9)

1.6.1	How many students participated for **BOTH COHF05D and PPAF05D**? **Solution:** Let the number $n(C \cap P) = x$. $150 = (70 - x) + x + (75 - x) + 10$ $150 = 155 - x$ $x = 5$ $therefore: n(C \cap P) = 5$	(3)
1.6.2	How many students participated for **COHF05D only**? **Solution:** $n(C - P) = n(C) - n(C \cap P)$ $n(C - P) = 70 - 5$ $n(C - P) = 65$	(2)

	1.6.3	Fill in the number of students in the Venn diagram below:  	(4)
1.7	Let C and D be 2 finite sets: *If* $n(A) = 10$ *and* $n(B) = 18$ *and* $n(A \cup B) = 26$, *determine* $n(A \cap B)$. **Solution:** $n(A \cap B) = n(A) + n(B) - n(A \cup B)$ $n(A \cap B) = 10 + 18 - 26$ $n(A \cap B) = 2$		(2)

Question 2: Show your calculations. [26]

2.1 Complete the following table: (4)

Indicate whether the following are statements or non-statements (Use 'X'):	Statement	Non-statement
$7 + 2 = 4$	X ✓	
Did you study for the test?		X ✓
You have to attend all class!		X ✓
The school bus alway arrive on time.	X ✓	

2.2 Given the following argument: (5)

Since we have corvered all the learning units and there is loadshedding everyday, we are now having online classes.

Identify the premise and the conclusion:

Premise:

(1) ***We have corvered all the learning units.*** ✓

(2) ***There is loadshedding everyday.*** ✓

Conclusion:

We are now having online classes. ✓

Translate the argument into standard form:

We have corvered all the learning units. ✓

There is loadshedding everyday.

We are now having online classes. ✓

2.3	*Let the propositions N and J be defined as:* ***N*: *Nozipho attend the online class.*** ***J*: *John watch the recording of the class.*** 2.3.1 Translate the symbolic form $\sim\sim N$ in words: (2) **Solution:** ***It is false that Nozipho did not attend the online class.*** 2.3.2 Translate the symbolic form $N \vee \sim J$ in words: (2) **Solution:** ***Nozipho attend the online class or John did not watch the recording of the class.*** 2.3.3 Translate the following sentence in a well-formed symbolic form: (2) ***Nozipho did not attend the online class if and only if John did not watch the recording of the class.*** **Solution:** $\sim N \leftrightarrow \sim J$ 2.3.4 Translate the following sentence in a well-formed symbolic form: (2) ***Nozipho attend the online class and John watch the recording of the class.*** **Solution:** $N \wedge J$	(10)

	2.3.5	What is the inverse of the following conditional statement: ***if Nozipho attend the online class, then John watch the recording of the class.*** **Solution:** ***if Nozipho did not attend the online class, then John did not watch the recording of the class.*** ✓	(2)	
2.4	Identify the main operator in the following: $\sim A \leftrightarrow B \vee C$ — Main Operator: $\leftrightarrow$ ✓ $A \wedge B \vee \sim C$ — Main Operator: $\vee$ ✓		(2)	
2.5	Complete the truth table below to determine if the following statement is a tautology, a contradiction or contingency. $L \wedge \sim T \longrightarrow T \vee \sim L$		(5)	

L	T	$\sim L$	$\sim T$	$L \wedge \sim T$	$T \vee \sim L$	$L \wedge \sim T \longrightarrow T \vee \sim L$
T	T	F	F	F	T	T
T	F	F	T	T	F	F
F	T	T	F	F	T	T
F	F	T	T	F	T	T
Marks:		(1) ✓	(1) ✓	(1) ✓	(1) ✓	(1) ✓

The statement is a Contingency. ✓ ← Award 1 mark if correct.

Question 3: Show your calculations. [20]

3.1 Given the number 45_{10}: (6)

3.1.1 Convert to Binary: (2)

		Rem
2	45	1
2	22	0
2	11	1
2	5	1
2	2	0
2	1	1
	0	

$45_{10} = 101101_2$

3.1.2 Convert to Octal: (2)

4	2	1	4	2	1
1	0	1	1	0	1
5			5		

$45_{10} = 55_8$

(Mark other method)

3.1.3 Convert to Hexadecimal: (2)

8	4	2	1	8	4	2	1
0	0	1	0	1	1	0	1
2				D			

$45_{10} = 2D_{16}$

(Mark other method)

3.2	Subtract the following unsigned binary numbers: **11011_2 and 111_2** **Solution:** 11011 − 111 10100 ✓	(2)
3.3	Find **$+68_{10}$** and **-68_{10}** in sign and size code representation using 8 bits. **Solution:** $+68_{10} = 01000100_2$ ✓ $-68_{10} = 11000100_2$ ✓	(3)

		Rem
2	68	0
2	34	0
2	17	1
2	8	0
2	4	0
2	2	0
2	1	1
	0	

3.4	Find the product of 11101_2 and 101_2 **Solution:** 11101 101 11101 + 00000 011101 + 11101 10010001_2	(3)
3.5	Calculate the following by making use of the 2's complement: $$01100110_2 - 01000100_2$$ **Solution:** $$01100110_2 + K_2(01000100_2)$$ $K_2(01000100_2)$ **Compliment :10111011_2** **Add 1 :1_2** **10111100_2** **01100110** **+10111100** **100100010 (discard 9th bit)** $$\mathbf{01100110_2 - 01000100_2 = 00100010_2}$$	(6)

Space for rough work