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

Tshwane University of Technology
We empower people

SUMMATIVE ASSESSMENT
PAPER 2 (Intervention)

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

_____

Signature

04 February 2022 Summative Assessment	Examiner: MS Sediela Co-Examiner: C Coetzee Moderator: D Masethe
Duration: 120 min Total: 92 Full Marks: 90 Number of Pages: 21	Number on Class List
	GROUP

Student Number

Surname	Initials

This paper consists of 21 pages

INSTRUCTIONS AND INFORMATION

- **Answer ALL** the questions.

- **Read ALL** the questions carefully.

- Non-programmable **calculators** are allowed.

- **No pencil** work will be marked, use a black/blue pen.

- Answers must be rounded to **2 decimals** (if not specified).

- All **exponents** in final answers must be **positive**.

- **Show all your calculations!**

QUESTION 1: Indicate if the following are true or false. [½ x 10 = 5]

	Questions	True	False
1.1	All composite numbers are counting numbers.	X ½	
1.2	Prime numbers include negative whole numbers		X ½
1.3	The first factor of a given number is 1, and the last factor is the number itself.	X ½	
1.4	5 is a factor but not a multiple of 5.		X ½
1.5	Prime numbers have one or more factors.		X ½
1.6	$\frac{5}{7}$ is rational.	X ½	
1.7	$9 + (7 + 3) = (9 + 7) + 9$ represent the Commutative Law of addition.		X ½
1.8	When doing calculations, multiplication must always be done before division.		X ½
1.9	Given $2x + 3y + 3 = 0$ the y-intercept ordered pair is (0, 3)		X ½
1.10	The gradient of a vertical line is undefined.	X ½	

Space for rough work

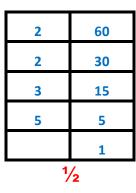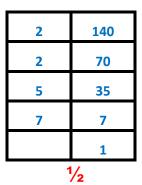|	**Show all your calculations (include units where applicable)**	
2.1	Lindiwe sells muffins during the school break. On Friday, she sold $\frac{5}{7}$ of the muffins that she baked. She had only 10 muffins left. How many muffins did she bake? **Solution:** $$Fraction\ left: 1 - \frac{5}{7} = \frac{2}{7} \quad ½$$ $$\frac{7}{2} \times 10 \quad ½$$ $$\frac{70}{2} \quad ½$$ $$35\ muffins \quad ½$$	2
2.2	Two neon lights are switched on at the same time. One flashes every 60 seconds and the other one every 140 seconds. In how many seconds will they flash together? **Solution:** <table><tr><td>2</td><td>60</td></tr><tr><td>2</td><td>30</td></tr><tr><td>3</td><td>15</td></tr><tr><td>5</td><td>5</td></tr><tr><td></td><td>1</td></tr></table> ½ <table><tr><td>2</td><td>140</td></tr><tr><td>2</td><td>70</td></tr><tr><td>5</td><td>35</td></tr><tr><td>7</td><td>7</td></tr><tr><td></td><td>1</td></tr></table> ½ $$60 = 2^2 \times 3 \times 5$$ $$140 = 2^2 \times 5 \times 7$$ $$LCM = 2^2 \times 3 \times 5 \times 7 = 420\ seconds \quad \checkmark$$	2

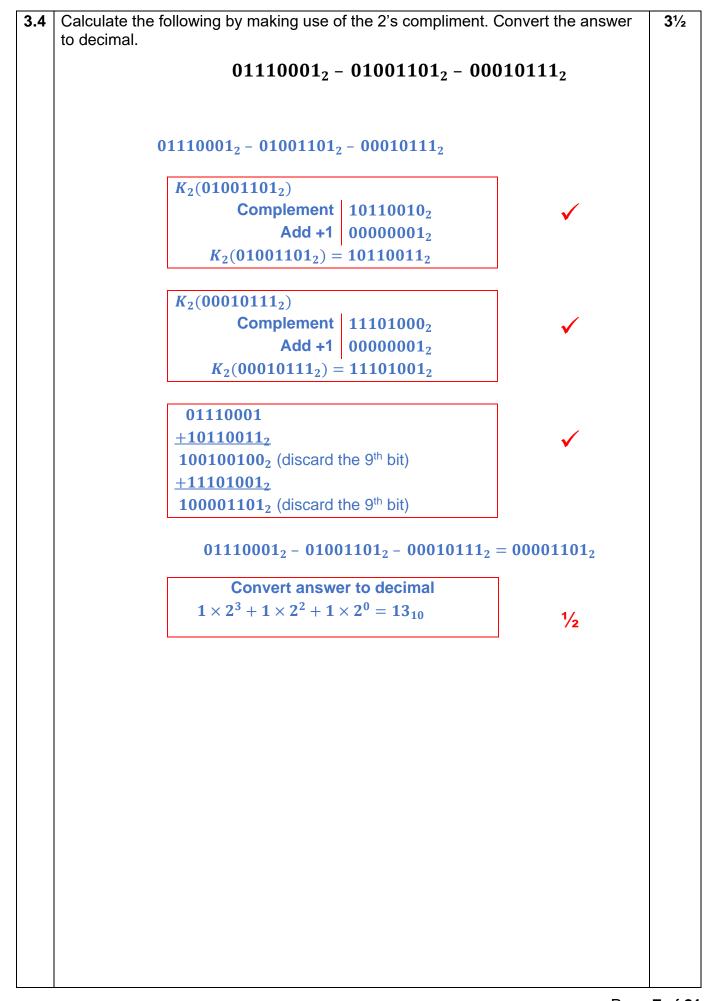| 2.3	The price of an item is R34.50 after adding a 15% VAT. What was the original price of the item?	2
	Solution: $$\frac{34.50}{1+0.15} ✔$$ $$\frac{34.50}{1.15}$$ $$R30.00 ✔$$	
2.4	Bongiwe offers free Mathematics extra classes to grade 10 students as part of her community project. She travels a certain distance to offer these classes at three schools. She travels a fifth of the distance to reach the first school. She travels two-thirds of the remaining distance to reach the second school. What fraction of the distance is remaining to reach the last school?	2
	Solution: $$first\ school: 1 - \frac{1}{5} = \frac{4}{5} \quad ½$$ $$second\ school: \frac{4}{5} \times \frac{2}{3} = \frac{8}{15} \quad ½$$ $$Fraction\ letf\ to\ reach\ last\ school: \frac{4}{5} - \frac{8}{15} = \frac{4}{15} \quad ✔$$	
2.5	It takes Lerato and Thabo 15 hours to develop a mobile application. How many people must they add to finish the same type of mobile application in 10 hours?	2
	Solution:	

People	hours
2	15
x	10

$$\frac{x}{2} = \frac{15}{10} \quad ✔$$

$$10x = 30$$

$$x = 3\ hours \quad ✔$$

	Show all your calculations	
3.1	Convert 7265_8 to binary and Hexadecimal numbers.	**2**

Convert to Binary:

7	2	6	5
111	010	110	101

½

$$7265_8 = 111010110101_2 \quad ½$$

Convert to Hexadecimal:

1110	1011	0101
14	11	5

½

$$7265_8 = EB5_{16} \quad ½$$

3.2	Calculate the product of **101101_2** and **110_2**.	**2½**

Solution:

```
        101101
      x   110
      000000      ½
     +101101      ½
      1011010     ½
     +101101      ½
      100001110   ½
```

3.3	The following numbers are represented in sign and size code using 7 bits: **0100101_2 and 1100101_2** Convert the numbers to decimal.	**2**

Solution:

$$1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 37 \quad ✓$$
$$0100101_2 = 37_{10} \quad ½$$
$$1100101_2 = -37_{10} \quad ½$$

3.4	Calculate the following by making use of the 2's compliment. Convert the answer to decimal.	3½

$$01110001_2 - 01001101_2 - 00010111_2$$

$01110001_2 - 01001101_2 - 00010111_2$

$K_2(01001101_2)$

Complement	10110010_2	✓
Add +1	00000001_2	

$K_2(01001101_2) = 10110011_2$

$K_2(00010111_2)$

Complement	11101000_2	✓
Add +1	00000001_2	

$K_2(00010111_2) = 11101001_2$

```
 01110001
+10110011₂
 100100100₂ (discard the 9ᵗʰ bit)
+11101001₂
 100001101₂ (discard the 9ᵗʰ bit)
```
✓

$01110001_2 - 01001101_2 - 00010111_2 = 00001101_2$

Convert answer to decimal
$1 \times 2^3 + 1 \times 2^2 + 1 \times 2^0 = 13_{10}$

½

	Show your calculation.	
4.1	Christopher is mowed the lawn of his garden. On Monday he mowed $\frac{2}{7}$ of the lawn and on Tuesday he mowed $\frac{1}{3}$ of the lawn. If 400 square metres is left to be mowed, what is the total area of the lawn? *(Use an equation to solve the problem)* *let x be Lerato's monthly allowance* $x - \frac{2}{7}x - \frac{1}{3}x = 400$ ✓ $21x - 21(\frac{2}{7}x) - 21(\frac{1}{3}x) = 21(400)$ ✓ $21x - 6x - 7x = 8400$ $8x = 8400$ ✓ $x = 1050 \; square \; metres$ ✓	**4**
4.2	A clothing shop sells designer shirts and unknown brand shirts. Sandra bought 3 designer shirts and 4 unknown brand shirts for R304.00. Nelson bought one designer shirt and one unknown brand shirt for R90.00. Calculate the price of one designer shirt and the price of one unknown brand shirt. *(Use equation(s) to solve the problem)* *let x be the price of a designer shirt* *let y be the price of unknown brand shirt* $3x + 4y = 304 \ldots\ldots (1)$ ✓ $x + y = 90 \ldots\ldots\ldots (2)$ ✓ *from* (2) $x = 90 - y \ldots\ldots\ldots (3)$ ✓ *sub* (3) *into* (1) $3(90 - y) + 4y = 304$ ✓ $270 - 3y + 4y = 304$ $y = 304 - 270$ $y = 34$ ✓	**6**

Price of designer shirt is R56.00 ✓

Price of unknown brand shirt is R34.00.

4.3 Calculate the value of k if $2y + x = 5 \ and \ 3kx + y = 4$ are perpendicular. | **4**

Solution:

$$2y + x = 5$$
$$y = -\frac{x}{2} + \frac{5}{2} \quad ✓$$

$$y = -3kx + 4 \quad ✓$$

perpendicular lines gradient product is equal to -1

$$-\frac{1}{2} \times -3k = -1 \quad ✓$$
$$k = -\frac{2}{3} \quad ✓$$

4.4 Simplify: | **4**

$$\frac{xy + 3x - 2y - 6}{(x-2)^2} + \frac{y}{2-x}$$

Solution:

$$\frac{x(y+3) - 2(y+3)}{(x-2)^2} - \frac{y}{x-2}$$

$$\frac{(y+3)(x-2)}{(x-2)(x-2)} - \frac{y}{x-2} \quad ✓$$

$$\frac{(y+3)}{x-2} - \frac{y}{x-2} \quad ✓$$

$$\frac{(y+3) - y}{x-2} \quad ✓$$

$$\frac{3}{x-2} \quad ✓$$

QUESTION 5 [6]

Show all your calculations.

| 5.1 | Michael is building a deck chair by placing strips of wood on an existing frame. He calculates that he will need 25 strips on the chair. | 3 |

(Picture shows concept only NOT the correct number of strips)

| 5.1.1 | If he cuts the wood into 0.8 m strips, what is the total length of wood needed? | **(1)** |

Solution:

$$25 \times 0.8 = 20m \quad ✓$$

| 5.1.2 | If the wood comes in 500 cm lengths, how many lengths will be needed? | **(1)** |

Solution:

cm	m
100	1
x	20

$$x = 2000 \, cm \quad ½$$
$$therefore: \frac{2000}{500} = 4 \, strips \quad ½$$

| 5.1.3 | If the dimension of each length of wood is 5 cm x 2 cm x 3 m, what is the total volume (in cubic metres) of wood needed? | **(1)** |

Solution:

$$V = 4(0.05 \times 0.02 \times 3) \quad ½$$
$$V = 0.012m^3 \quad ½$$

5.2	Kate started driving at 07:00 from a point at a rate of 40 km/h. Joyce started driving one hour later than Kate from the same point, going in opposite directions at a rate that is 10 km/h faster than Kate's speed. At what time will they be 220 km apart?	3

Solution:

$$d_J + d_J = 220$$

$$s_K t_K + s_J t_J = 220$$

$$40t + (40 + 10)(t - 1) = 220 \quad \checkmark$$

$$40t + 50t - 50 = 220$$

$$90t = 270$$

$$t = 3\ hours \quad \checkmark$$

$$therefore: 07:00 + 3\ hours = 10:00 \quad \checkmark$$

Space for rough work

6.1	The data below shows the number of cars that passed through a toll gate over a period of 40 days.	7½

55	70	57	73	55	59	64	72
60	48	58	54	69	51	63	78
75	64	65	57	71	78	76	62
49	66	62	76	61	63	63	76
52	76	71	61	53	56	67	71

6.1.1	Calculate the average number of cars that pass through the toll gate per day.	(1)

$$mean = \frac{55 + 70 + \cdots + 67 + 71}{40}$$
$$mean = \frac{2557}{40} \quad \text{½}$$
$$mean = 63.93 \quad \text{½}$$

6.1.2	If the standard deviation is 8.62, between which numbers do 99% of the dataset lie?	(2)

$$63.93 + (3 \times 8.62) = 89.79 \quad \checkmark$$

$$63.93 - (3 \times 8.62) = 38.07 \quad \checkmark$$

$$95\% \; of \; the \; number \; of \; cars \; are \; between \; 38.07 \; and \; 89.79$$

6.1.3	Calculate the range of the dataset.	(1)

$$range = largest - smallest$$
$$range = 78 - 48 = 30 \quad \checkmark$$

6.1.4	Calculate the class interval if you must present the dataset in 10 classes.	(1)

$$class \; interval = \frac{range}{number \; of \; classes}$$
$$class \; interval = \frac{30}{10} \quad \text{½}$$
$$class \; interval = 3 \quad \text{½}$$

	6.1.5	Which graph is the most suitable represent the above dataset?	(1)	
		Histogram ✓		
	6.1.6	What type of data was captured during this study? Indicate the **3 correct descriptions** with an 'X'	(1½)	

Numerical	**X** ½
Categorical	
Discrete	**X** ½
Continuous	
Nominal	
Ordinal	
Qualitative	
Quantitative	**X** ½

6.2	In a study at a school about the usage of the new learning management system, 250 randomly selected learners participated. The results showed that 75% of the learners use the learning management system.	**2**

	6.2.1		(1)

What is the size of the population?	**All learners at school** ½
What is the size of the sample?	**250** ½

	6.2.2	What type of sampling was used? Indicate the 2 **correct descriptions** with an 'X'	(1)

Probability	**X** ½
Non-Probability	
Cluster	
Stratified	
Systematic	
Simple Random	**X** ½
Volunteer	
Purposive	
Convenient	

6.3	Data was collected about the number of students who attended the STUDYTHON daily from Monday to Sunday. The graph below represents the number of students who attended the STUDYTHON from Monday to Sunday.	2½

6.3.1	Is this an example of a histogram or a bar graph? **Bar graph** **½**	½
6.3.2	What is the percentage of the students who attended the STUDYTHON on Tuesday? $\frac{32}{224} \times 100 = 14.29$ % **½**	½
6.3.3	Which other type of graph can be used to represent this data? **Pie Chart** **½**	½
6.3.4	What is the percentage difference between the LEAST number of students and the MOST number of students? $Percentage\ change = \frac{40-22}{22} \times 100 = 81.82\%$ ✓	1

QUESTION 7 [18]

Show all your calculations		

7.1	Given set B = { a, b, c }. Answer the following question about the subsets of set A.	**1½**

	Question	Answer	
7.1.1	List subsets of set B that have zero elements.	**{ }**	(½)
7.1.2	List subsets of set B that have one element (singleton subsets of set A)?	**{a}, {b}, {0}**	(½)
7.1.3	List subsets of set B that have two elements?	**{a, b}, {a, c}, {b, c}**	(½)

7.2	Complete the following table:	**1**

Set Builder Notation	Enumeration Method (Roster Method)
$\{2x \mid x \in \mathbb{N}_0, x \leq 4\}$ **½**	$\{0, 2, 4, 6, 8\}$
$\{2x + 1 \mid x \in \mathbb{N}, 1 \leq 2x + 1 < 7\}$	$\{3, 5\}$ **½**

7.3	Given the following Venn diagram:	**5**

Let W represent animals living in water.
Let M represent animals that are mammals

Answer the following questions:

Question		Answer	
7.3.1	n($W \cap M$)	**1**	(½)
7.3.2	n(P($W \cap M$))=	**2**	(½)

7.3.3	Use a binary table to determine all possible subsets of set M. (4)

Decimal Numbers	Binary Numbers			Subsets
	Lion	Dog	Whale	
0	**0**	**0**	**0**	{ } **½**
1	**0**	**0**	**1**	{$Whale$} **½**
2	**0**	**1**	**0**	{Dog } **½**
3	**0**	**1**	**1**	{$Dog, Whale$} **½**
4	**1**	**0**	**0**	{$Lion$ } **½**
5	**1**	**0**	**1**	{$Lion, Whale$} **½**
6	**1**	**1**	**0**	{ $Lion, Dog$} **½**
7	**1**	**1**	**1**	{$Lion, Dog, Whale$} **½**

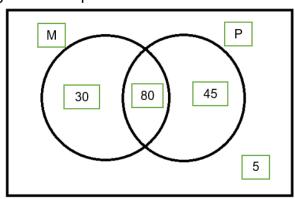| **7.4**	The head of department of a school has surveyed 160 students about their favourite subject. Of the 160 students:	**2½**

- 110 favour Math,
- 125 favour Physics,
- 5 neither favour Math nor Physics.

Let **M** be the set of students whofavour Maths.
Let **P** be the set of students who favour in Physics.

Draw a Venn Diagram that represents the number of students.

7.5	Consider the following sets: $A = \{a, e, i, o, u\}, \quad B = \{y, e, a, r\} \text{ and } C = \{d, a, t, e\}.$ List the following sets:	1

$B - C$	$\{y, r\}$ ½
$A \, \Delta \, C$	$\{i, o, u, d, t\}$ ½

7.6	Let H and J be finite sets: $If\ n(H - J) = 50\ and\ n(H \cup J) = 80\ and\ n(J - H) = 20, determine\ n(H)$ **Solution:** $$n(H \cup J) = n(H - J) + n(H \cap J) + n(J - H) \quad \checkmark$$ $$80 = 50 + n(H \cap J) + 20 \quad \checkmark$$ $$n(H \cap J) = 80 - 70$$ $$n(H \cap J) = 10 \quad \checkmark$$ $$therefore: n(H) = n(H \cap J) + n(H - J) \quad \checkmark$$ $$n(H) = 10 + 50 = 60 \quad \checkmark$$	5

7.7	$If\ B = \{2, 4\}\ and\ C = \{1, 2, 3, 4, 5, 6\},$ State if the following is true or false.	2

Statement	True	False
$B \subset C$	X ½	
$C \subseteq B$		X ½
$B \supset C$		X ½
$C \supseteq B$	X ½	

8.1	Given the propositions defined as follows:		**3**

L: *Lerato likes to shop online*.
N: *Nandi likes to shop online*.

8.1.1	Translate the following sentences in a well-formed symbolic form:	**(1)**

Sentence	Symbolic form	
Lerato likes to shop online and Nandi does not like to shop online.	$L \wedge \sim N$	**(½)**
If Lerato does not like to shop online, then Nandi likes to shop online.	$\sim L \rightarrow N$	**(½)**

8.1.2	Translate the formed symbolic form into words:	**(1)**

Symbolic form	Sentence	
$\sim L \wedge \sim N$	**Both Lerato and Nandi do not like to shop online.**	**(½)**
$L \leftrightarrow \sim N$	**Lerato likes to shop online if and only if Nandi does not like to shop online.**	**(½)**

8.1.3	Write the contrapositive of the following statement in words.	**(1)**

*If Lerato likes to shop online
then Nandi likes to shop online*.

*If Nandi does not like to shop online
then Lerato does not like to shop online*. ✓

8.2	Given the following argument:	2
	James has a better chance of winning the race since	
	he is faster and stronger.	
	Identify the premise and the conclusion from the above argument.	
	Premise:	
	He is faster and stronger. ✓	
	Conclusion:	
	James has a better chance of winning the race. ✓	

8.3	Given the propositions defined as follows:	8
	L: *Louis mark the papers*. M: *Marlene add the marks*. T: *Tumelo capture the marks*.	

	8.3.1	Translate the following sentence in a well-formed symbolic form:	(1)
		if Louis mark the papers and Tumelo capture the marks, Marlene add the marks.	
		$(L \wedge T) \rightarrow M$ ✓	
	8.3.2	Complete the truth table (on the next page) for the following statement: $[L \vee \sim L] \leftrightarrow [\sim (\sim M \wedge \sim T) \rightarrow (M \vee T)]$	(6)
	8.3.3	Is the above statement is a tautology, a contradiction or contingency? Explain your answer. **Tautology. Because the last column only consist of T's.** ✓	(1)

Complete the Truth Table (<u>Question 8.3.2</u>) for $[L \lor \sim L] \leftrightarrow [\sim (\sim M \land \sim T) \rightarrow (M \lor T)]$

L	M	T	~L	~M	~T	$L \lor \sim L$	$\sim M \land \sim T$	$\sim (\sim M \land \sim T)$	$M \lor T$	$\sim (\sim M \land \sim T) \rightarrow (M \lor T)$	$[L \lor \sim L] \leftrightarrow [(\sim M \land \sim T) \rightarrow \sim (M \lor T)]$
T	T	T	F	F	F	T	F	T	T	T	T
T	T	F	F	F	T	T	F	T	T	T	T
T	F	T	F	T	F	T	F	T	T	T	T
T	F	F	F	T	T	T	T	F	F	T	T
F	T	T	T	F	F	T	F	T	T	T	T
F	T	F	T	F	T	T	F	T	T	T	T
F	F	T	T	T	F	T	F	T	T	T	T
F	F	F	T	T	T	T	T	F	F	T	T
Mark allocation (1 mark per column)						✔	✔	✔	✔	✔	✔

Space for rough work