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

Tshwane University of Technology
We empower people

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

Question	Mark
1	
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8	
TOTAL	
Percentage	

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Signature

SUMMATIVE ASSESSMENT
PAPER 1

Computational Mathematics and Discrete Mathematics (Extended) (Year 1)

COHF05D & DSMF06D

MEMO

10 November 2022 Duration: 120 min Total: 103 Full Marks: 100 Number of Pages: 20	Examiner: MS Sediela co-Examiner: C Coetzee Moderator: D Masethe	
	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. **[10]**

	Questions	True	False
1.1	The LCM of two prime number is their product.	x ✓	
1.2	$\sqrt{7}$ and $\sqrt[3]{9}$ are rational numbers.		x ✓
1.3	Numerical data represent quantity of things, and things that we can measure.	x ✓	
1.4	ICT 1st Years and Foundation students represent a population of the entire group of ICT students.		x ✓
1.5	The gradient of a vertical line is 0.		x ✓
1.6	The straight line graph equation **y = -1** is a horizontal line.	x ✓	
1.7	$a(b + c) = ab + ac$ represents the Distributive Law.	x ✓	
1.8	$100\ cm^2 = 1\ m^2$		x ✓
1.9	"$4 / 3 = 1$" is a non-statement.		x ✓
1.10	"**The number 2 is the only even number**" is a statement	x ✓	

Space for rough work

QUESTION 2 **[14]**

Show all your calculations (include units where applicable)		
2.1	Khomotso is reading a software engineering book that has 150 pages. On a Monday he read $\frac{1}{5}$ of the number of pages. On Tuesday he read $\frac{1}{3}$ of the remaining number of pages. How many pages are left to read? **Solution:** $Monday: 150 \times \frac{1}{5} = 30\ pages$ ✓ $Remaining: 150 - 30 = 120\ pages$ ✓ $Tuesday: 120 \times \frac{1}{3} = 40\ pages$ ✓ $Left\ to\ read: 120 - 40 = 80\ pages$ ✓	**4**
2.2	Students are going to a sport event. The university has hired buses. According to law, each bus may only transport 63 students. 470 students indicated they want to go to the event. How many buses will carry each 63 students? How many students will the last bus transport? No overloading is allowed. **(Make use of floor, ceiling or mod operators):** **Solution:** $470 \backslash 63 = 7\ buses$ ✓ $470\ mod\ 63 = 29\ students$ ✓	**2**
2.3	After a discount of 20%, the price of a bicycle is R4500. What was the original price? **Solution:** $\frac{4500}{1-0.2}$ ✓ $= R5625.00$ ✓	**2**

2.4	A lecturer has 2 class groups. Each group has 56 and 35 students. One of the class activities requires that the students be divided into smaller groups of the same size. What is the maximum number of students per smaller groups, if all groups must be of the exact same size? **Solution:** $56 = 2^3 \times 7$ $35 = 5 \times 7$ $HCF = 7\ students\ per\ group$ ✓	**3**

2	56
2	28
2	14
7	7
	1

5	35
7	7
	1

2.5	Six men can do a job in 12 days. How long will it take 8 men to do the same job, working at the same pace? **Solution:** ✓ $\frac{6}{8} = \frac{x}{12}$ ½ $8x = 72$ ½ $x = 9\ days$ ✓	**3**

Men	Days
6	12
8	x

QUESTION 3 **[12]**

Show your calculation.

3.1 Puleng is 4 times as old as Boitumelo. In 12 years' time Puleng will be twice as old as Boitumelo. What are their current ages? **5**

Let x be Boitumelo's age now.

Fill in the below table:

	Age now	Age in 12 years
Boitumelo	x	$x + 12$ ✓
Puleng	$4x$	$4x + 12$ ✓

Find their ages.

Solution:

$$4x + 12 = 2(x + 12) \checkmark$$

$$4x + 12 = 2x + 24$$

$$2x = 12$$

$$x = 6 \checkmark$$

$$Boitumelo\ is\ 6\ years\ old.$$

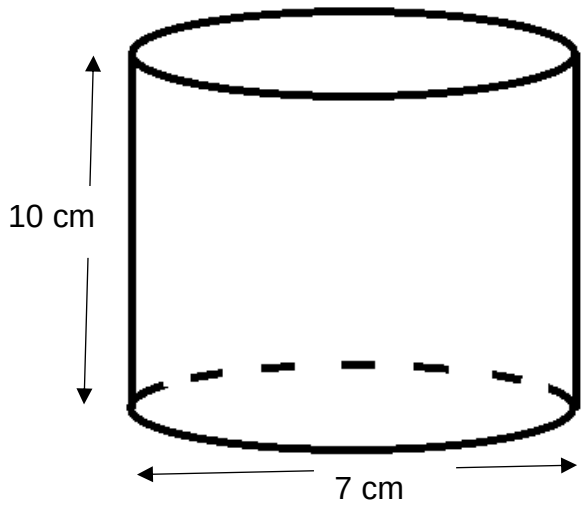
$$Puleng's\ age = 4(6) = 24\ years\ old \checkmark$$

3.2	Calculate the value of k if $2y + x = 5$ *and* $3kx + y = 4$ are parallel. **Solution:** $2y + x = 5$ $y = -\frac{x}{2} + \frac{5}{2}$ ✓ $y = -3kx + 4$ ✓ *parallel lines have equal gradients*: $-\frac{1}{2} = -3k$ ✓ $k = \frac{1}{6}$ ✓	**4**
3.3	Simplify: $\frac{6x - 12}{7x + 14} \times \frac{(x+2)^2}{x^2 - 4}$ **Solution:** $= \frac{6(x-2)}{7(x+2)} \times \frac{(x+2)(x+2)}{(x-2)(x+2)}$ ✓✓ $= \frac{6}{7}$ ✓	**3**

QUESTION 4 [6]

Show all your calculations.

4.1 You are given a can with the measurements below: **6**



Answer the following questions:

4.1.1 You are required to put a label on the can, excluding the top and bottom of the can. Calculate the area of the label. **(4)**

Solution:

$$r = \frac{7}{2} \checkmark$$

$$Circumference = 2\pi r$$
$$Circumference = 2\pi(3.5)$$
$$Circumference = 21.99\ cm \checkmark$$

$$Area = 10 \times 21.99 = 219.9\ cm^2 \checkmark\checkmark$$

4.1.2 Calculate the volume of the can? **(2)**

Solution:

$$Volume = \pi r^2 \times h$$
$$Volume = \pi(3.5)^2 \times 10 \checkmark$$
$$Volume = 384.85\ cm^3 \checkmark$$

4.2 Mr T travelled for *6 hours* partly by car at *110 km/h* and partly by aeroplane at *240 km/h.* He travelled *1180 km* altogether. How long did he travel in the aeroplane? **5**

Solution:

$$\boldsymbol{let\ x\ be\ the\ the\ number\ of\ hours\ travelled\ by\ car}$$

Fill in the table below:

	Speed (*km/h*)	Time (*h*)	Distance (*km*)
Car	$\mathbf{110}$	$\boldsymbol{x}$	$\mathbf{110x}$ ✓
Aeroplane	$\mathbf{240}$	$\mathbf{6-x}$	$\mathbf{240(6-x)}$ ✓

Show your calculations:

$$\mathbf{110x + 240(6 - x) = 1180}$$ ✓

$$\mathbf{110x + 1440 - 240x = 1180}$$

$$\mathbf{110x + 1440 - 240x = 1180}$$

$$\mathbf{-130x = -260}$$

$$\boldsymbol{x = 2\ hours}$$ ✓

$$\boldsymbol{Time\ by\ aeroplane = 6 - 2 = 4\ hours}$$ ✓

QUESTION 5 [13]

5.1 The data below shows the heights of athletes in centimetres. **8**

165.2	166	166	166.5	169	169.8	170.1	170.2
171	171.6	172	172	172	172.1	172.3	173

5.1.1 Calculate the average height of the athletes. **(1)**

$$mean = \frac{165.2+166+\cdots+172.3+173}{16}$$

$$mean = \frac{2718.8}{16} \quad ½$$

$$mean = 169.93\ cm \quad ½$$

5.1.2 What is the mode of the data set. **(1)**

172 ✓

5.1.3 If the standard deviation is 2.53, between which numbers do 70% of the data set lie? **(2)**

$$169.93 + 2.53 = 172.46 \quad ✓$$

$$169.93 - 2.53 = 167.4 \quad ✓$$

$$70\%\ of\ the\ heights\ are\ between\ 167.4\ and\ 167.4$$

5.1.4 Which graph is the most suitable to represent the above data set? **(1)**

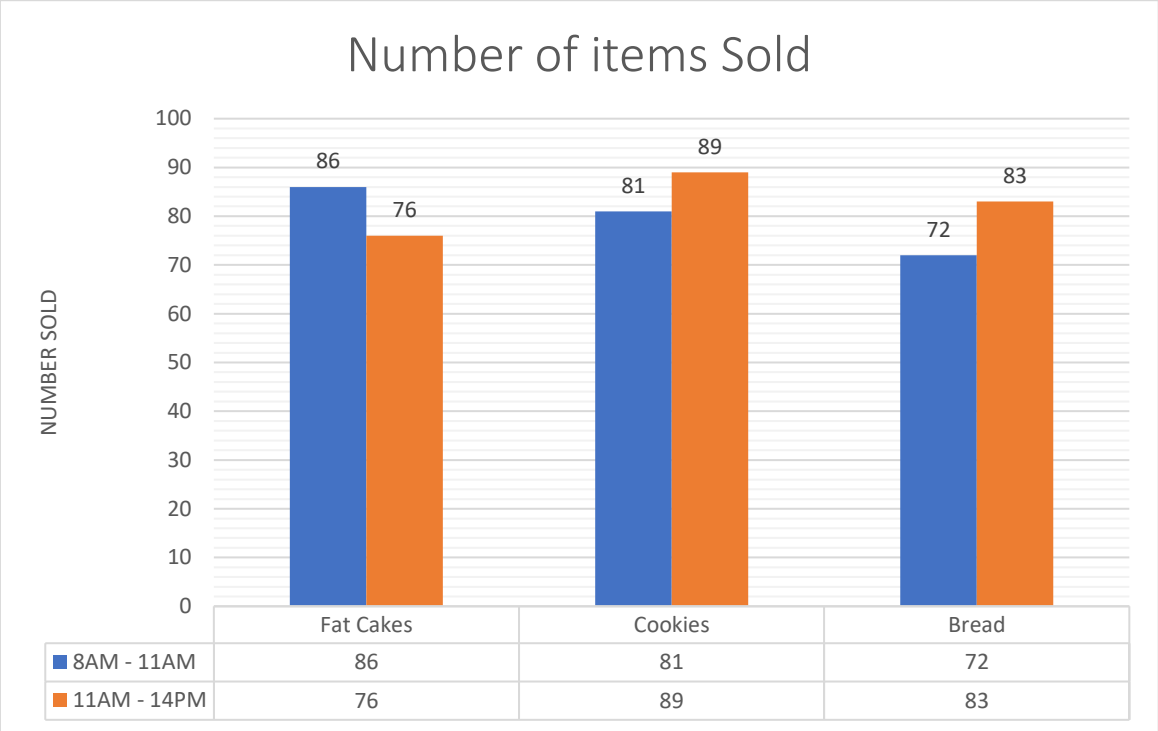
Histogram ✓

5.1.5 What type of data was captured during this study? **(3)**

Indicate the **3 correct descriptions** with an 'X'

Numerical	X ✓
Categorical	
Discrete	
Continuous	X ✓
Nominal	
Ordinal	
Qualitative	
Quantitative	X ✓

5.2	Lindiwe bakes Fat Cakes, Cookies, and Bread. She sells them at school from 08:00 to 14:00. On one Monday she decided to keep track of the number of Fat Cakes, Cookies and Bread sold. She has recorded the numbers sold from 08:00 – 11:00 and again from 11:00 – 14:00. The graph below shows the data collected:	**5**



5.2.1	Is the above graph an example of a histogram or a bar graph? **Bar graph** ✓	**1**
5.2.2	Which item was the most favourite from 11:00 – 14:00? **Cookies** ✓	**1**
5.2.3	Which item was the least favourite for the day? **Bread** ✓	**1**
5.2.4	By what percentage did the number of Fat Cake decrease from the time intervals 08:00 –11:00 to 11:00 – 14:00? $Percentage\ change = \frac{86-76}{86} \times 100 = 11.63\%$ ✓✓	**2**

QUESTION 6 **[17]**

Show all your calculations

6.1 **2**

Complete the following table:

Set Builder Notation	Enumeration Method (Roster Method)
$\{5x \mid x \in \mathbb{N}_0, x \leq 3\}$ ✓	$\{0, 5, 10, 15\}$
$\{3x + 1 \mid x \in \mathbb{N}, 1 \leq x < 5\}$	$\{4, 7, 10, 13\}$ ✓

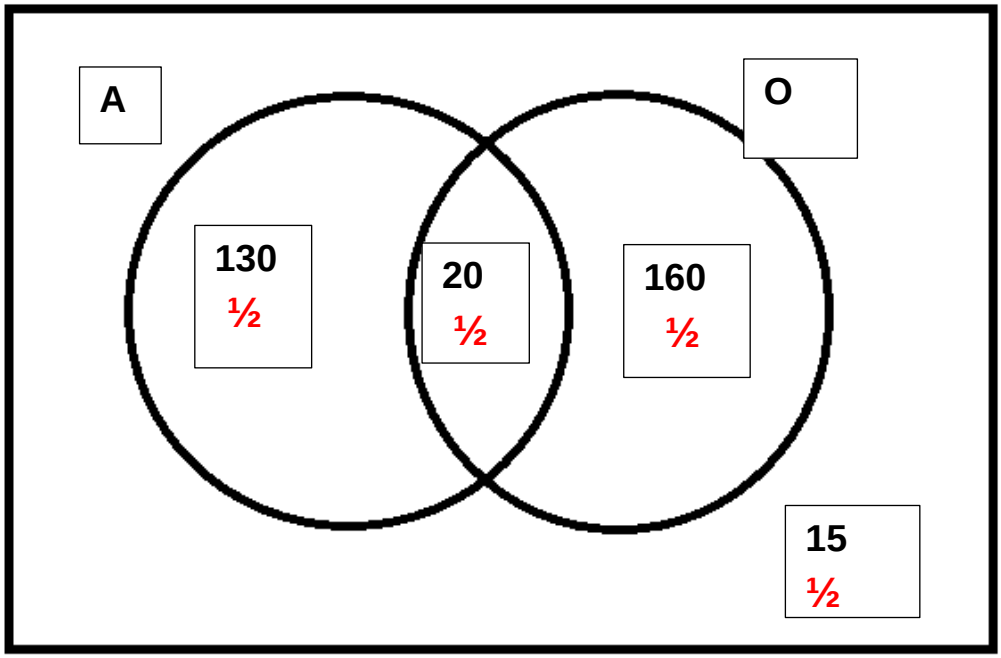
6.2 **9**

Given the following sets.

$$Let\ \mathcal{U} = \{2, 3, 4, 5, 6, 7, 8\}$$
$$Let\ E = \{2, 4, 6\}$$
$$Let\ Q = \{2, 3, 5, 7\}$$

Determine the following:

Question		Answer	
6.2.1	$n(Q) =$	4	(1)
6.2.2	$n(P(Q)) =$	16	(1)
6.2.3	$\overline{E} =$	$\{3, 5, 7, 8\}$	(1)
6.2.4	$E \cap Q =$	$\{2\}$	(1)
6.2.5	$n(\overline{E \cup Q}) =$	1	(1)
6.2.6	$P(E) =$	$\{\{\}, \{2\}, \{4\}, \{6\}, \{2, 4\}, \{2, 6\}, \{4, 6\}, \{2, 4, 6\}\}$	(2)
6.2.7	$E - Q =$	$\{4, 6\}$	(1)
6.2.8	$E \Delta Q =$	$\{3, 4, 5, 6, 7\}$	(1)

6.3	A group of 325 people were surveyed about their favourite fruits. Let $\boldsymbol{O}$ be the set of people who likes oranges. Let $\boldsymbol{A}$ be the set of people who likes apple competition. The results of the survey are as follows: • $\boldsymbol{n(O) = 150}$ • $\boldsymbol{n(A) = 180}$ • $\boldsymbol{n(\overline{O \cup A}) = 15}$ Draw a Venn Diagram that represents the people's fruit preference. **(2)**  **Show your calculations below:** **(2)** $\boldsymbol{n(A \cup O) = 325 - 15 = 310}$ ½ $\boldsymbol{n(A \cap O) = (150 + 180) - 310 = 20}$ ½ $\boldsymbol{n(A - O) = 150 - 20 = 130}$ ½ $\boldsymbol{n(O - A) = 180 - 20 = 160}$ ½	**4**

6.4	$\boldsymbol{If\ B = \{4, 8, 12, 16\},}$ State if the following is true or false.	**2**

	Statement	True	False
6.4.1	$\{\} \subseteq \boldsymbol{B}$	X ½	
6.4.2	$\{4, 16\} \subset \boldsymbol{B}$	X ½	
6.4.3	$\{4, 8, 12, 16\} \supset \boldsymbol{B}$		X ½
6.4.4	$\{8, 12, 4, 16\} \supseteq \boldsymbol{B}$	X ½	

Space for rough work

QUESTION 7 **[12]**

	Show all your calculations	
7.1	Convert $\mathbf{1001011101100_2}$ to hexadecimal and decimal numbers. **Convert to Hexadecimal:** | 0001	0010	1110	1100
---	---	---	---
1	2	14=E	12=C | $$1001011101100_2 = 12EC_{16}$$ ✓ **Convert to Decimal:** $$1 \times 2^{12} + 1 \times 2^9 + 1 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^3 + 1 \times 2^2 = 4844_{10}$$ ✓	**2**
7.2	Subtract the following unsigned binary numbers: $$\mathbf{1001001_2}\ \boldsymbol{and}\ \mathbf{10111_2}$$ **Solution:** $$\begin{array}{r} 1001001 \\ -\ \ 10111 \\ \hline 0110010_2 \end{array}$$ ✓✓	**2**
7.3	Which possible range of sign and size code values can be represented using 6 bits? **(Show your calculations)** **Solution:** $$-(2^{n-1}-1)\ to\ (2^{n-1}-1)$$ ✓ $$-(2^{6-1}-1)\ to\ (2^{6-1}-1)$$ ½ $$-(32-1)\ to\ (32-1)$$ ½ $$-31\ to\ 31$$ ✓	**3**

7.4	Calculate the following by making use of the 2's compliment. $$\mathbf{01110010_2 - 01000010_2 - 00000101_2}$$	**5**

$\mathbf{01110010_2 + K_2(01000010_2) + K_2(00000101_2)}$ ✓

$\mathbf{K_2(01000010_2)}$

Complement	$\mathbf{10111101_2}$
Add +1	$\mathbf{00000001_2}$

$\mathbf{K_2(01000010_2) = 10111110_2}$ ✓

$\mathbf{K_2(00000101_2)}$

Complement	$\mathbf{11111010_2}$
Add +1	$\mathbf{00000001_2}$

$\mathbf{K_2(00000101_2) = 11111011_2}$ ✓

$\mathbf{01110010_2}$
$\mathbf{+10111110_2}$
$\mathbf{100110000_2}$ (discard the 9th bit)
$\mathbf{+11111011_2}$
$\mathbf{100101011_2}$ (discard the 9th bit) ✓

$\mathbf{01110010_2 - 01000010_2 - 00000101_2 = 00101011_2}$ ✓

QUESTIONS 8 **[16]**

8.1 (2)

Given the following argument:

$$\textit{Cars drive faster on national routes than on district routes.}$$

$$\textit{National routes are thus more dangerous for pedestrians than district routes.}$$

Write the argument in standard form:

✓

$$\textit{Cars drive faster on national routes than on district routes}$$

$$\textit{National routes are thus more dangerous for pedestrians than district routes.}$$

✓

8.2 (14)

Given the propositions defined as follows:

$$P\text{: Portia will set the test.}$$
$$N\text{: Nandi will moderate the test.}$$
$$J\text{: John will mark the scripts.}$$

8.2.1 (1)

Translate the following sentences in a well-formed symbolic form:

$$\textit{It is false that Portia will not set the test.}$$

Solution:

$$\sim\sim P$$ ✓

	8.2.2	Translate the following sentences in a well-formed symbolic form: $$\boldsymbol{John\ will\ mark\ the\ scripts\ if\ and\ only\ if, Portia\ will\ set\ the\ test\ and\ Nandi\ will\ moderate\ the\ test.}$$ **Solution:** $$J \leftrightarrow (P \wedge N)$$ ✓✓	**(2)**		
	8.2.3	Translate the symbolic form $\sim P \longrightarrow \sim N$ in words: ✓✓ $$\boldsymbol{if\ Portia\ will\ not\ set\ the\ paper\ then, Nandi\ will\ not\ moderate\ the\ paper.}$$	**(2)**		
	8.2.4	Given the following contrapositive statement: $$\boldsymbol{if\ John\ will\ not\ mark\ the\ scripts\ then, Portia\ will\ not\ set\ the\ paper.}$$ Translate it back to a conditional statement in words: ✓✓ $$\boldsymbol{if\ Portia\ will\ set\ the\ paper\ then, John\ will\ mark\ the\ scripts.}$$	**(2)**		
	8.2.5	Make use of the truth table (On the next page) to prove that the following statements are logically equivalent: $$\sim(P \longrightarrow N)\ \boldsymbol{and}\ \sim(\sim P \vee N)$$ Are the statements logically equivalent? Why? Yes, because their bi-conditional yields a tautology. ✓	**(7)**		

Complete the Truth Table (Question 8.3.2) for $\sim(P \rightarrow N)$ *and* $\sim(\sim P \vee N)$

P	N	$\sim P$	$P \rightarrow N$	$\sim(P \rightarrow N)$	$\sim P \vee N$	$\sim(\sim P \vee N)$	$\sim(P \rightarrow N) \leftrightarrow \sim(\sim P \vee N)$
T	T	F	T	F	T	F	T
T	F	F	F	T	F	T	T
F	T	T	T	F	T	F	T
F	F	T	T	F	T	F	T
Mark Allocation			✓	✓	✓	✓	**✓ for correct operator used, ✓ for correct truth values**

Space for rough work