UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME   :   DISCRETE MATHEMATICS

COURSE CODE   :   DAT 10203

PROGRAMME CODE   :   DAT

EXAMINATION DATE   :   JULY/AUGUST 2023

DURATION   :   3 HOURS

INSTRUCTIONS   :   1. ANSWER ALL QUESTIONS

                         2. THIS FINAL EXAMINATION IS
                            CONDUCTED VIA **CLOSED BOOK**.

                         3. STUDENTS ARE **PROHIBITED** TO
                            CONSULT THEIR OWN MATERIAL OR
                            ANY EXTERNAL RESOURCES DURING
                            THE EXAMINATION CONDUCTED VIA
                            CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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Q1   X and Y are the two finite sets, such that $n(X \cup Y) = 36$, $n(X) = 20$, and $n(Y) = 28$. Find $n(X \cap Y)$.

(5 marks)

Q2   Given A = {0, 1, 2} and B = {1, 2, 3}. a R b if and only if $a < b$.

Based on the above statement:

(a)   List the Cartesian Product for A x B.

(5 marks)

(b)   Create a table for checking purposes.

(5 marks)

(c)   Write the final answer for a R b.

(3 marks)

Q3   Let L be the set of all lines in the XY plane, and R be the relation in L defined as R = {(L_1, L_2): L_1 is parallel to L_2}. Proof that R is an equivalence relation. The solution must follow Polya's Four-Step Problem-Solving Process.

(9 marks)

Q4   Given that $f(x) = 2 + 3x$ and $g(x) = \dfrac{2x - 1}{3}$. Find:

(a) $f(g(2))$

(4 marks)

(b) $f(f(-2))$

(4 marks)

Q5   Let P(x) be the statement "x is even" and Q(x) be the statement "x is a prime number". R(x,y) be the statement "x+y is even". The variables x and y represent integers. Write an English sentence corresponding to each of the following:

(a) $\forall x \, \exists y \, R(x,y)$

(2 marks)

(b) $\exists x \, \forall y \, R(x,y)$

(2 marks)

(c) $\sim(\exists x \, P(x))$

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(2 marks)

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Q6   Create the truth table for each of the following propositions:

(a) $\sim p \wedge (q \vee r)$

(6 marks)

(b) $p \wedge (\sim (q \vee \sim r))$

(7 marks)

Q7   Identify the rules of inference used in each of the following arguments:

(a)   If it is rainy, then the pool will be closed. It is rainy. Therefore, the pool is closed.

(6 marks)

(b)   If it snows today, the university will be closed. The university is not closed today. Therefore, it did not snow today.

(6 marks)

Q8   A boy living at X wants to attend school at Z, for which he first has to reach Y and then from Y to Z. The X to Y route has three bus routes and two train routes. There are four bus routes and five train routes from Y to Z. Calculate the number of ways to go from X to Z.

(6 marks)

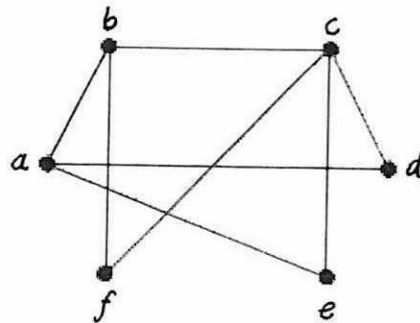**Q9**   Determine whether **Figure Q9** is bipartite. Justify your answer.

Figure Q9

(3 marks)

Q10   Build a binary search tree for the word banana, peach, apple, pear, coconut, mango and papaya using alphabetical order.

(7 marks)

Q11   Convert **Figure Q11** to an adjacency matrix.
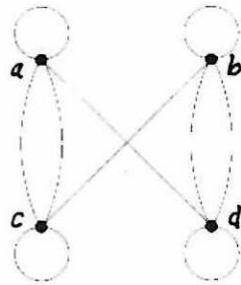

Figure Q11

(8 marks)

Q12   Identify the time complexity of the following code.

```
1    for(int i = 0 ; i < n; i++) {
2      printf("%d ", i);
3      i++;
4    }
```

(5 marks)

Q13   Based on **Table Q13**, select the dominant term(s) having the steepest increase in n and specify the Big-O notation.

Table Q13

Expression	Dominant Term	Big-O Notation
$5 + 0.001n^3 + 0.025n$		
$500n + 100n^{1.5} + 50 \log_{10} n$		
$2n^2 + 3n^3 + 100$		
$\log_2 n + 5n$		
$n \log_2 n + 2n$		

(5 marks)

-END OF QUESTIONS –

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