Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	DISCRETE STRUCTURE
COURSE CODE	:	BIT 11003
PROGRAMME CODE	:	BIT
EXAMINATION DATE	:	JULY / AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION		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

Q1 (a) Answer **Q1(a)(i)** to **Q1(a)(iv)** according to **Figure Q1(a)**.

Suppose A is the set of distinct letters in the word 'elephant', B is the set of distinct letters in the word 'sycophant', C is the set of distinct letters in the word 'fantastic' and D is the set of distinct letters in the word 'student'. The universe U is the set of 26 lower-case letters of the English alphabet.

Figure Q1(a)

Find the following;

(i) $A \cup B$.

(2 marks)

(ii) $A \cap C$.

(2 marks)

(iii) $A \cap (C \cup D)$.

(3 marks)

(iv) $(A \cup B \cup C \cup D)'$.

(3 marks)

(b) In a group of students enrolled in a Programming classroom, 6 students are experts in Java, 15 students are experts in PHP, and 6 students are experts in C#. Nobody in that group is an expert in any other programming language. If 2 students in the group are expert in two languages and one student expert in all three programming languages, then how many students are there in the group?

(5 marks)

Q2 (a) Suppose that a function, f is defined recursively by

$$f(0) = 5$$
$$f(n+1) = 3f(n) + 2$$

Find the first five terms of the function.

(5 marks)

(b) Use mathematical induction to prove that $(3^n + 7^n - 2)$ is divisible by 8 for $n \geq 1$.

(10 marks)

Q3 (a) If R is the relation on the set of positive integers such that $(a, b) \in R$ if and only if $a^2 + b$ is even, prove that R is an equivalence relation.

(10 marks)

(b) Given $g = \{(1, a), (2, a), (3, c)\}$ a function from $X = \{1,2,3\}$ to $Y = \{a, b, c\}$ and $f = \{(a, y), (b, x), (c, z)\}$ a function from Y to $Z = \{x, y, z\}$.

Find the value of $g \circ f$.

(5 marks)

Q4 (a) A particle is moving in the horizontal direction. The distance it travels in each second is equal to two times the distance it traveled in the previous second. a_r denoted the position of the particle in the r^{th} second. Determine a_r given that $a_0 = 3$ and $a_3 = 10$.

(10 marks)

(b) A price of machinery is worth RM30,000.00 at present. The value of the machinery falls at a rate of 10% per year. How many years will it take for the value to fall below RM14,000.00?

(10 marks)

Q5 (a) Answer **Q5(a)(i)** to **Q5(a)(v)** according to **Figure Q5(a).**

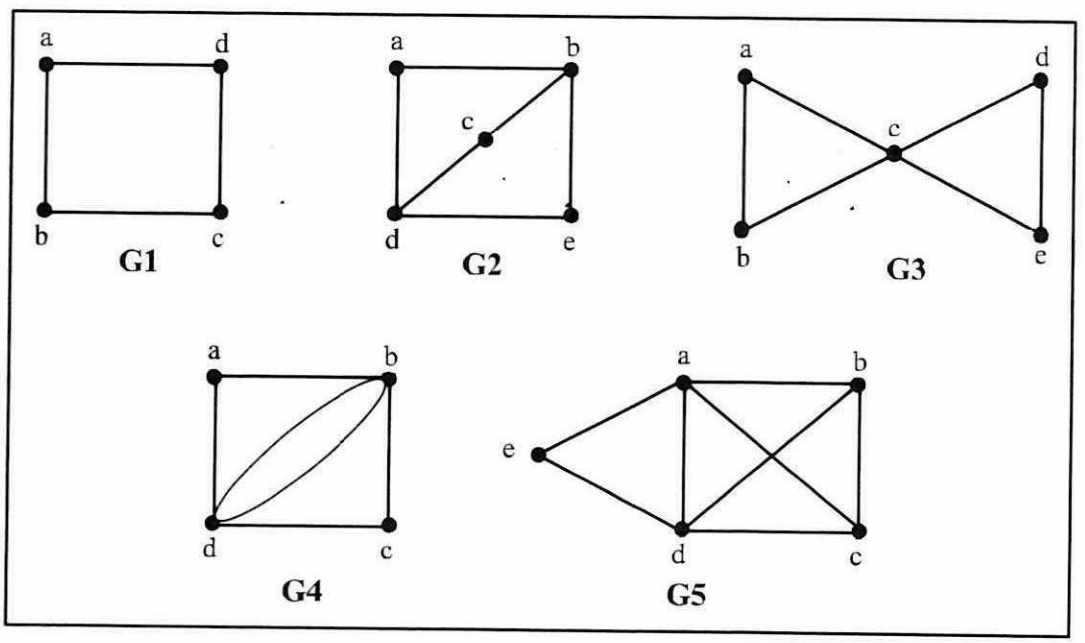

Figure Q5(a)

Identify which graph contains

(i) an Eulerian circuit that is also a Hamiltonian circuit.

(1 mark)

(ii) neither an Eulerian circuit nor a Hamiltonian circuit.

(1 mark)

(iii) an Eulerian circuit and a Hamiltonian circuit that are distinct.

(1 mark)

(iv) an Eulerian circuit, but not a Hamiltonian circuit.

(1 mark)

(v) a Hamiltonian circuit, but not an Eulerian circuit.

(1 mark)

(b) Find the shortest path between the vertices A and H in the weighted graph given in **Figure Q5(b)** by using Dijkstra's algorithm.

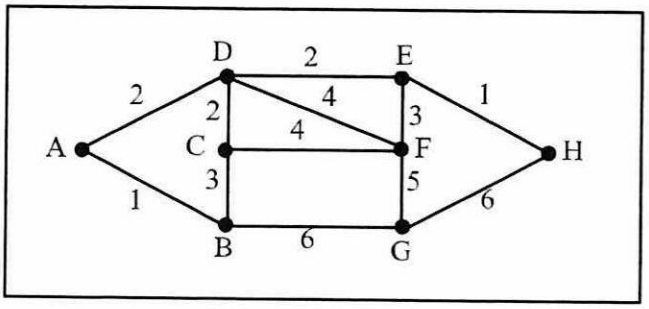

Figure Q5(b)

(10 marks)

- END OF QUESTIONS –