



**UTHM**

Universiti Tun Hussein Onn Malaysia

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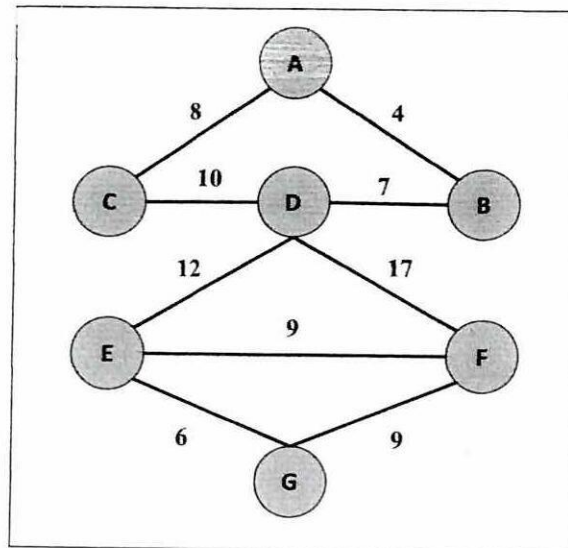
**FINAL EXAMINATION  
SEMESTER II  
SESSION 2022/2023**

- COURSE NAME : ALGORITHM AND COMPLEXITY  
COURSE CODE : BIE 20303  
PROGRAMME CODE : BIP  
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 **THREE (3)** PAGES

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- Q1**
- (a) Specify the algorithm design technique type of the merge sort algorithm. (3 marks)
  - (b) Write a merge sort algorithm for a set of numbers  $\{a_1, a_2, \dots, a_n\}$ . (4 marks)
  - (c) Show the steps to sort the numbers  $\{8, 13, 7, 16, 10, 22, 5\}$  using the merge sort algorithm. (5 marks)
  - (d) Estimate the best case complexity of the merge sort algorithm. (4 marks)
  - (e) Estimate the average case complexity of the merge sort algorithm. (4 marks)
  - (f) Estimate the worst case complexity of the merge sort algorithm. (4 marks)
- Q2**
- (a) Write a recursive algorithm for computing  $a^n$  where  $a$  is a nonzero real number and  $n$  is a nonnegative integer. (5 marks)
  - (b) Write a recursive algorithm for finding the minimum or smaller  $x$  of a finite set of  $n$  integers. (5 marks)
  - (c) Estimate the time complexity of the algorithm in **Q2(b)**. (5 marks)
  - (d) Construct a recursive version of a binary search algorithm. (5 marks)
  - (e) Use the algorithm in **Q2(d)** to search for the number 20 in the set  $\{1, 2, 3, 5, 6, 7, 8, 10, 12, 13, 15, 16, 18, 19, 20, 22\}$ . (5 marks)

**Q3** Answer Q3(a) to Q3(e) based on **Figure Q3**.



**Figure Q3**

- (a) Find the adjacency matrix of the weighted graph. (5 marks)
- (b) Find the adjacency list of the weighted graph. (5 marks)
- (c) Find the shortest path between the vertices A and G using Dijkstra's algorithm. (5 marks)
- (d) Write a Prim's algorithm for Minimum Spanning Tree (MST). (5 marks)
- (e) Estimate the time complexity of the Prim's algorithm for MST based on the answer in Q3(d). (5 marks)

- END OF QUESTIONS -

**TERBUKA**