



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

- COURSE NAME : DISCRETE STRUCTURE
- COURSE CODE : BIC 10103
- PROGRAMME CODE : BIS/ BIP/ BIW/ BIM
- EXAMINATION DATE : FEBRUARY 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.

TERBUKA

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

- Q1 (a) Suppose that a function, f is defined recursively by

$$\begin{aligned}f(0) &= 2 \\f(n+1) &= 3f(n) - 1\end{aligned}$$

Find the first five terms of the function.

(5 marks)

- (b) Use mathematical induction to prove that $5^n + 3$ is divisible by 4 for all positive integer n .

(10 marks)

- Q2 (a) Show that the relation R in the set $A = \{1,2,3,4,5\}$ given by $R = \{(a,b) : |a-b| \text{ is even}\}$ is an equivalence relation. Show that all the elements of $\{1,3,5\}$ are related to each other and all elements of $\{2,4\}$ are related to each other. But no elements of $\{1,3,5\}$ is related to any elements of $\{2,4\}$.

(10 marks)

- (b) Let $f: \{1,3,4\} \rightarrow \{1,2,5\}$ and $g: \{1,2,5\} \rightarrow \{1,3\}$ be given by $f = \{(1,2), (3,5), (4,1)\}$ and $g = \{(1,3), (2,3), (5,1)\}$.

Find out the value of $g \circ f$.

(5 marks)

- Q3 (a) A person deposits RM1,000 in an account that yields 9% interest compounded annually. Set up a recurrence relation for the amount in the account at the end of n years and how much will be in the account after 10 years.

(5 marks)

- (b) Formulate a solution to the following recurrence relations.

$$a_n = 5a_{n-1} - 6a_{n-2} \text{ where } a_0 = 1, a_1 = 0.$$

(8 marks)

TERBUKA

Q4 (a) Consider the following pseudocode segment.

```
1   y = x + x + x + x + x
2   z = y + y + y
```

- (i) Identify the number of operations in the pseudocode segment. (2 marks)
- (ii) If $x = 3$ before the segment is executed, identify the value of z after execution. (2 marks)

(b) Consider the following pseudocode segments. Show the number of words that each algorithm print.

```
for i = 1 to 9
  for j = 1 to 6
    for k = 1 to 3
      print "she wins"
```

(3 marks)

(c) Consider the following algorithm.

```
Procedure linear search (x: integer, a1, a2, ..., an: distinct
integer)
i = 1
while (i ≤ n and x ≠ ai)
  i = i + 1
if i ≤ n then location = i
else location = 0
return location {location is the subscript of the term
equals x, or is 0 if x is not found}
```

- (i) Suppose that $a_i = \{21, 9, 13, 27\}$ and the algorithm requires to locate an element of 27. Calculate the number of comparisons made by this algorithm. (6 marks)
- (ii) Determine the time complexity of the algorithm. (2 marks)
- (iii) Find the big-O estimation for the worst-case analysis of the algorithm. (2 marks)

TERBUKA

Q5 (a) Answer Q5(a)(i) – Q5(a)(ii) based on Figure 5(a).

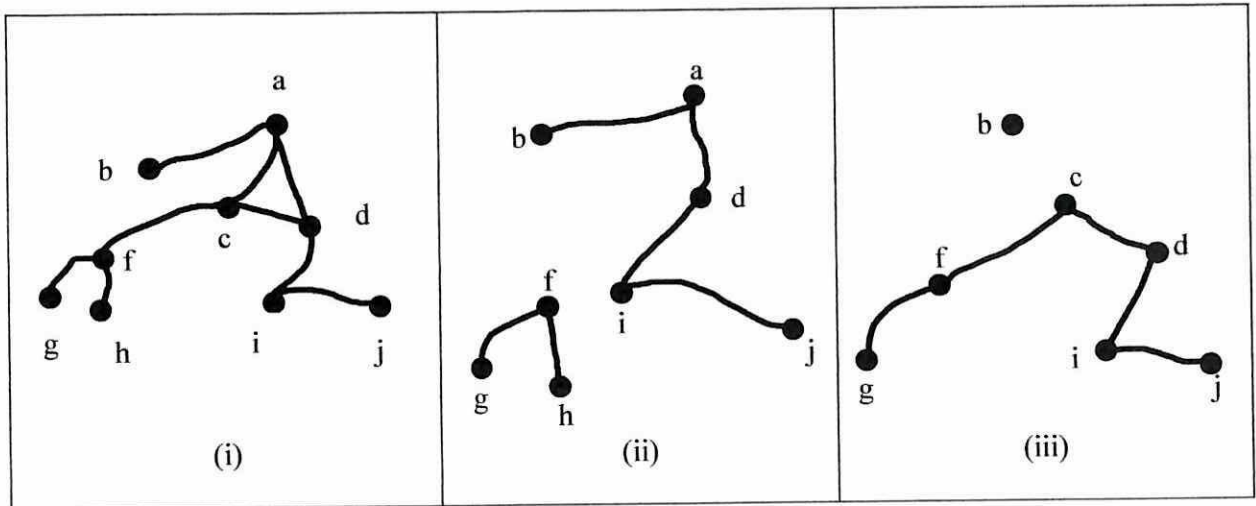


FIGURE 5(a)

- (i) How many connected subgraphs which have four vertices and include a path? (1 mark)
- (ii) How many spanning subgraphs are there for the graph (i). (2 marks)
- (b) Draw the subgraph of G induced by the set of vertices $U = \{b, c, d, f, i, j\}$ (5 marks)
- (c) If G is the graph in Figure 5(b), the edges $\{a, b\}\{b, c\}\{c, f\}\{f, e\}\{e, d\}\{d, g\}\{g, h\}\{h, i\}$ is Hamilton path for G . Explain whether G have a Hamilton cycle or not.

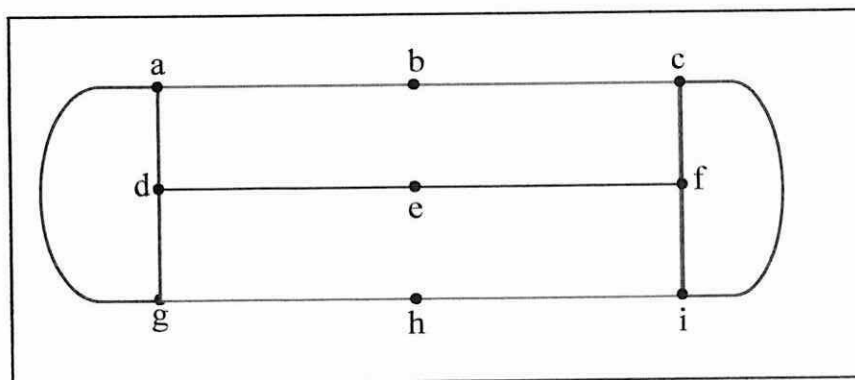


FIGURE 5(b)

(12 marks)

TERBUKA

- END OF QUESTIONS -