

**CONFIDENTIAL**



**UTHM**

Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER I  
SESSION 2020/2021**

COURSE NAME : DISCRETE STRUCTURE  
COURSE CODE : BIC10103  
PROGRAMME CODE : BIP / BIS / BIW / BIM  
EXAMINATION DATE : JANUARY / FEBRUARY 2021  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS

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

**CONFIDENTIAL**

**TERBUKA**

- Q1** (a) Given  $A = \{1, 2, 3, 4\}$  and  $B = \{x, y, z\}$ .  
Let  $R$  be the following relation from  $A$  to  $B$ :
- $$R = \{(1, y), (1, z), (3, y), (4, x), (4, z)\}$$
- (i) Determine the matrix of the relation. (4 marks)
- (ii) Draw the arrow diagram of  $R$ . (4 marks)
- (iii) Find the inverse relation  $R^{-1}$  of  $R$ . (3 marks)
- (iv) Determine the domain and range of  $R$ . (3 marks)
- (b) Consider the set  $A = \{\text{one, two, three, four, five, six, seven, eight, nine, ten}\}$ .  
Identify the equivalence classes in each of the following relations on  $A$ :
- (i) Begins with same letter of the alphabet (2 marks)
- (ii) Has the same number of letter (2 marks)
- (iii) Has the same remainder when divided by three (2 marks)
- Q2** (a) An algorithm has a Big O notation as  $O(n^3)$ , requires 50 seconds to solve a problem of size  $n = 16$ . How long will it take the algorithm to solve a problem of size  $n=20$ ? (10 marks)

**TERBUKA**

- (b) Estimate the time complexity,  $T(n)$  and Big O notation,  $O(n)$  of the algorithm. (10 marks)

```

i = 1;
sum = 0;
while (i <= n)
{
    j = 1;
    while (j <= n)
    {
        sum = sum + 1;
        j = j + 1;
    }
    i = i + 1;
}

```

- Q3** (a) Every spring a nearby supermarket are stocked with 5000 catfish. Due to fishing and environmental conditions, the population of catfish  $n$  weeks after the stock date is given by

$$P_n = P_{n-1} + (0.05) \times P_{n-1} - 500$$

Starting with the first week and continuing until there are no catfish left. Find a closed formula for the number of catfish  $n$  weeks after the stock date. What is the value of  $n$  when lake has no catfish?

(5 marks)

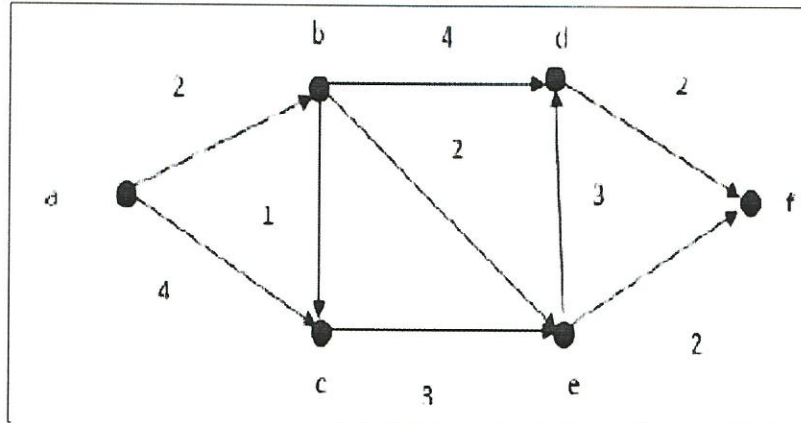
- (b) A single pair of rabbits (male and female) is born at the beginning of a year. Assume the following conditions (which are more realistic than Fibonacci's):
- (i) Rabbit pairs are not fertile during their first month of life but there after give birth to four new male/female pairs at the end of every month
  - (ii) No rabbits die.

Let  $r_n$  to be the number of pairs of rabbits alive at the end of month  $n$ , for each integer  $n \geq 1$ , and let  $r_0 = 1$ . a recurrence relation for  $r_0, r_1, r_2, r_3, r_4, r_5$  and  $r_6$   
How many rabbits will there be at the end of the year?

(15 marks)

**TERBUKA**

**Q4** Use the Dijkstra's algorithm to find the shortest path from a to f in **FIGURE Q4**.

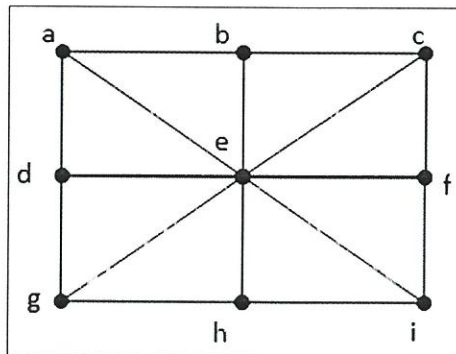


**FIGURE Q4**

(10 marks)

**Q5** Determine whether the given graph in **FIGURE Q5** has a Hamilton circuit or not. Construct the circuit if exist. If no Hamilton circuit exist, determine whether the graph has a Hamilton path or not. Construct the path if exist.

(10 marks)



**FIGURE Q5**

- END OF QUESTIONS -

**TERBUKA**