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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : DISCRETE STRUCTURE  
COURSE CODE : BIT 11003 / BIC 10103  
PROGRAMME CODE : BIT  
EXAMINATION DATE : JANUARY / FEBRUARY 2021  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS

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

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- 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) 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)

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- (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 thereafter 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  $n > 1$ , 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)

- Q3** (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)

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

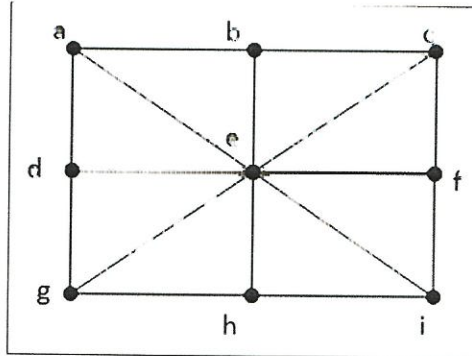
(10 marks)

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

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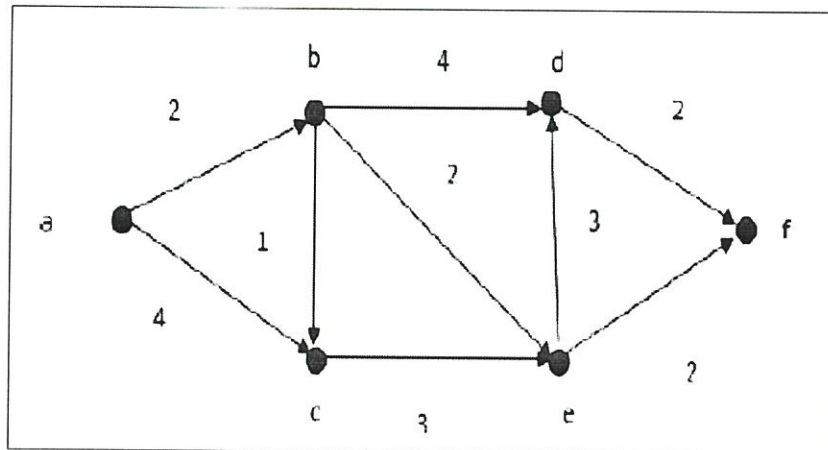
- Q4** Determine whether the given graph in **FIGURE Q4** has a Hamilton circuit or not. Construct the circuit if exist. If no Hamilton circuit exist, determine whether the graph has a Hamilton path or not. Construct the path if exist.

(10 marks)



**FIGURE Q4**

- Q5** Use the Dijkstra's algorithm to find the shortest path from a to f in **FIGURE Q5**



**FIGURE Q5**

(10 marks)

- END OF QUESTIONS -

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