UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018

COURSE NAME	:	ALGORITHM AND COMPLEXITIES
COURSE CODE	:	BIE 20303
PROGRAMME CODE	:	BIP
EXAMINATION DATE	:	DECEMBER 2017 / JANUARY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

TERBUKA

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

Q1   (a)   Write an algorithm for quick sort for a set of numbers $\{a_1, \dots, a_n\}$.

                                                           (5 marks)

         (b)   Estimate the time complexity of the algorithm as in **Q1(a)** in the best case analysis based on order of magnitude

                                                           (5 marks)

Q2   (a)   Let S_n be a sequence of 5, 8, 11, ..., $(3n+2)$. Find a series of S_n.

                                                           (6 marks)

         (b)   Write a recursive algorithm to answer **Q2(a)**.

                                                           (4 marks)

Q3   (a)   Let f be an increasing function that satisfies the recurrence relation

```
f(n) = a*f(n/b) + c
```

Show that whenever n is divisible by b, where $a \geq 1$, b is an integer greater than 1, and c is a positive real number. Then

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f(n) is O(log n) when a =1.
```

                                                           (6 marks)

         (b)   Find $f(n)$ when $n = 2^k$, where f satisfy the following recurrence relation

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f(n) = f(n/2) + 5 with f(1) = 1.
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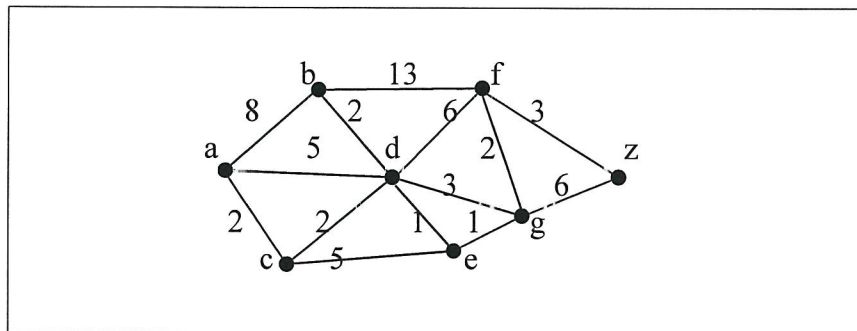   (4 marks)

Q4 (a) Write a Dijkstra's algorithm for weighted graph issue.

(4 marks)

(b) Find the length of shortest path between the vertices a and z in the weighted graph in **Figure Q4**. Show the steps.

(6 marks)

Figure Q4

Q5 (a) Suppose that a computer can execute an operation of an algorithm in 10^{-15} seconds. What is the largest size problem that can be solved on such machine for different durations and running times for **Table 1**?

(6 marks)

Table 1: The largest size problems that can be solved

	n	n^2	n^3	2^n
1 hour				
10 hours				
100 hours				
1000 hours				

(b) Convert the satisfiable statement $(A \cup B) \to (C \to D)$ into conjunctive normal form (CNF), where A, B, C and D are literals.

(4 marks)

- END OF QUESTIONS –

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