UNIVERSITI TEKNOLOGI MARA
FINAL EXAMINATION

COURSE	:	**DATA STRUCTURES AND ALGORITHMS**
COURSE CODE	:	**ECE532**
EXAMINATION	:	**JUNE 2016**
TIME	:	**3 HOURS**

INSTRUCTIONS TO CANDIDATES

1. This question paper consists of five (5) questions.
2. Answer ALL questions in the Answer Booklet. Start each answer on a new page.
3. Do not bring any material into the examination room unless permission is given by the invigilator.
4. Please check to make sure that this examination pack consists of:
   i) the Question Paper
   ii) an Answer Booklet – provided by the Faculty
5. Answer ALL questions in English.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

This examination paper consists of 6 printed pages

QUESTION 1

a) Define asymptotic notation use in the algorithm analysis.

(2 marks)

b) What is define by upper bound and lower bound that measure the algorithm complexity?

(3 marks)

c) Describe two (2) terms that are used to measure the efficiency of a computer program?

(5 marks)

d) Differentiate between linear and non linear data structure with examples.

(5 marks)

e) Write the sequence of push and pop items from a C++ program shown in **Figure Q1e.** Then, write the expected output from the program.

```
1   #include <iostream>
2   #include <stack>
3   using namespace std;
4   int main()
5   {
6   stack<int> stackObject;
7   int i =0;
8
9   while(i<5)
10   {
11       i++;
12       stackObject.push(i);
13   }
14  while(!stackObject.empty())
15   {
16       cout << stackObject.top() << endl;
17       stackObject.pop();
18   }
19  return 0;
20  }
```

Figure Q1e

(5 marks)

QUESTION 2

a) Simulate the action of converting a postfix expression in **Figure Q2a** to an infix expression.

A B C D E/ * - F / G + +

Figure Q2a

(6 marks)

b) Explain the rationale of converting infix to either postfix or prefix that makes any expression easier to process by a computer stack.

(4 marks)

c) Based on linked list in **Figure Q2c(i)**, describe what happened to the linked list if the function in **Figure Q2c(ii)** is executed. Your description must include the movement of the four pointers, namely the head, tail, current and save pointers, for each iteration cycle.

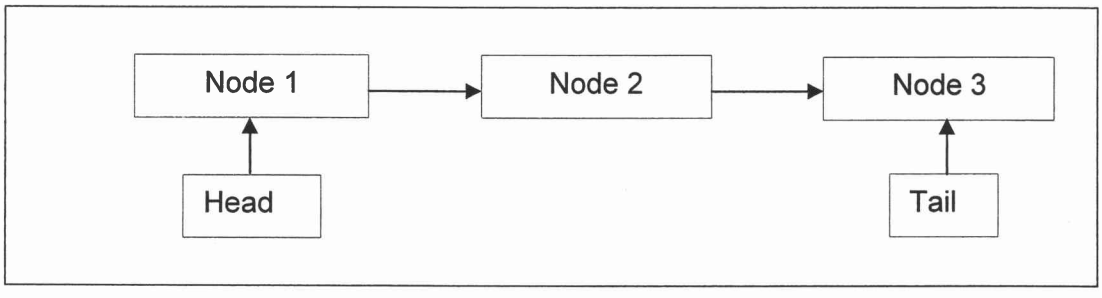

Figure Q2c(i)

```
void AnotherFunction( ) {

    tail = head;
    node *current = head;
    head = NULL;

    while (current != NULL) {

        node *save = current;
        current = current->next;
        save->next = head;
        head = save;

    }
}
```

Figure Q2c(ii)

(10 marks)

QUESTION 3

a) For the Binary Search Tree shown in **Figure Q3a**, write the postorder and preorder traversals of the tree.

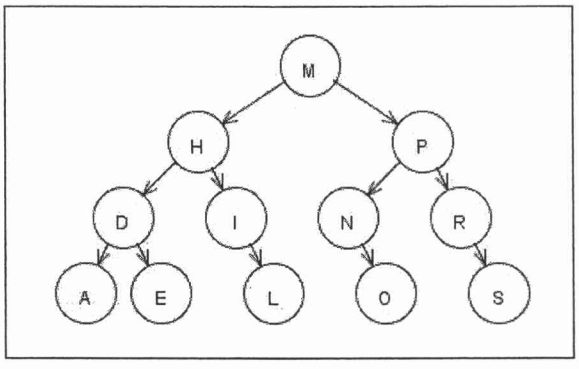

Figure Q3a

(6 marks)

b) What is the benefit of storing data in binary search tree (BST)? If the size of data is 2^100, what is the speed in asymptotic notation the BST better from linear search?

(6 marks)

c) Given a binary tree shown in **Figure Q3c(i)**, write function(s) to print out the nodes of the tree according to **inorder traversal.** The binary tree is built with a node type a in **Figure 3c(ii)**

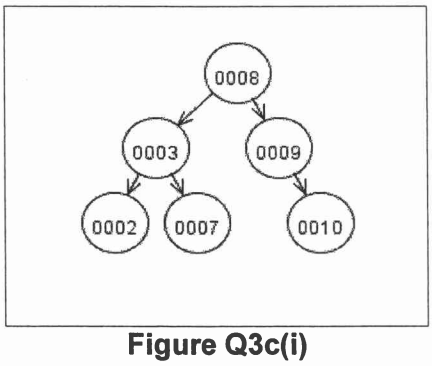

Figure Q3c(i)

```
struct node {
int data;
struct node* left;
struct node* right;
}
```

Figure 3c(ii)

(8 marks)

QUESTION 4

a) Quick sort is an efficient sorting technique which is based on divide and conquer strategy. Demonstrate in details the sorting process using quick sort algorithm on an array for *list = {50, 30, 10, 90, 80}*. Assume your pivot = 50.

(10 marks)

b) Analyze how quick sort and merge sort differ from insertion, selection and bubble sort?

(6 marks)

c) Compare the internal operation of merge sort and quicksort algorithm.

(4 marks)

QUESTION 5

a) The Djikstra's algorithm is use to find the shortest path between two (2) nodes. Using this algorithm find the shortest path between node 0 and node 5 in graph illustrated in **Figure Q5a**. Your answer should include steps taken to determine the shortest path and cost of the shortest path.

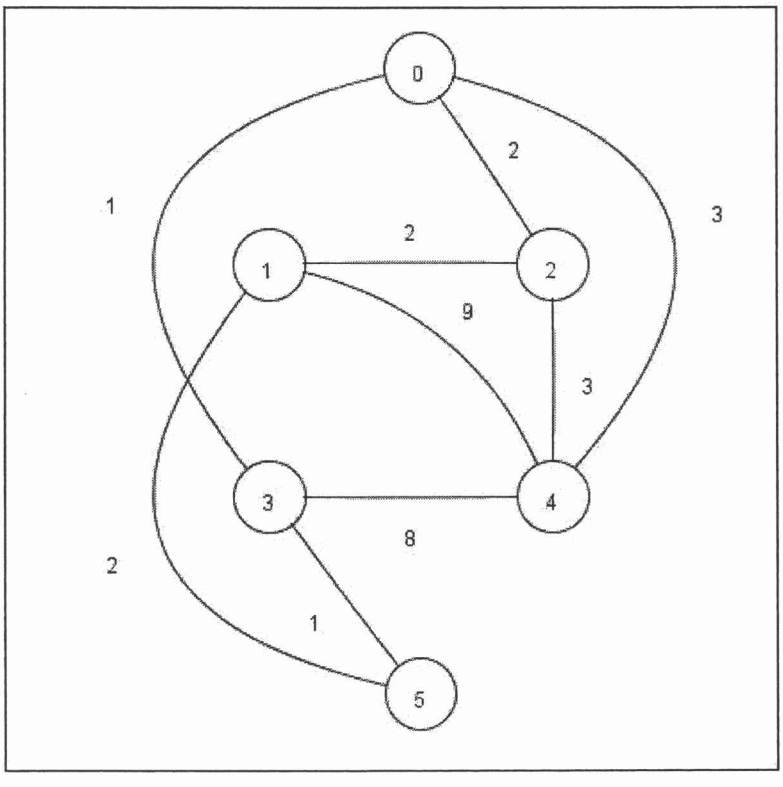

Figure Q5a

(10 marks)

b) A Spanning tree is a graph which all the vertices of graph are present but it may not contain all the edges. Using Prim's Algorithm find the **minimum** Spanning Tree for graph in **Figure Q5b.**

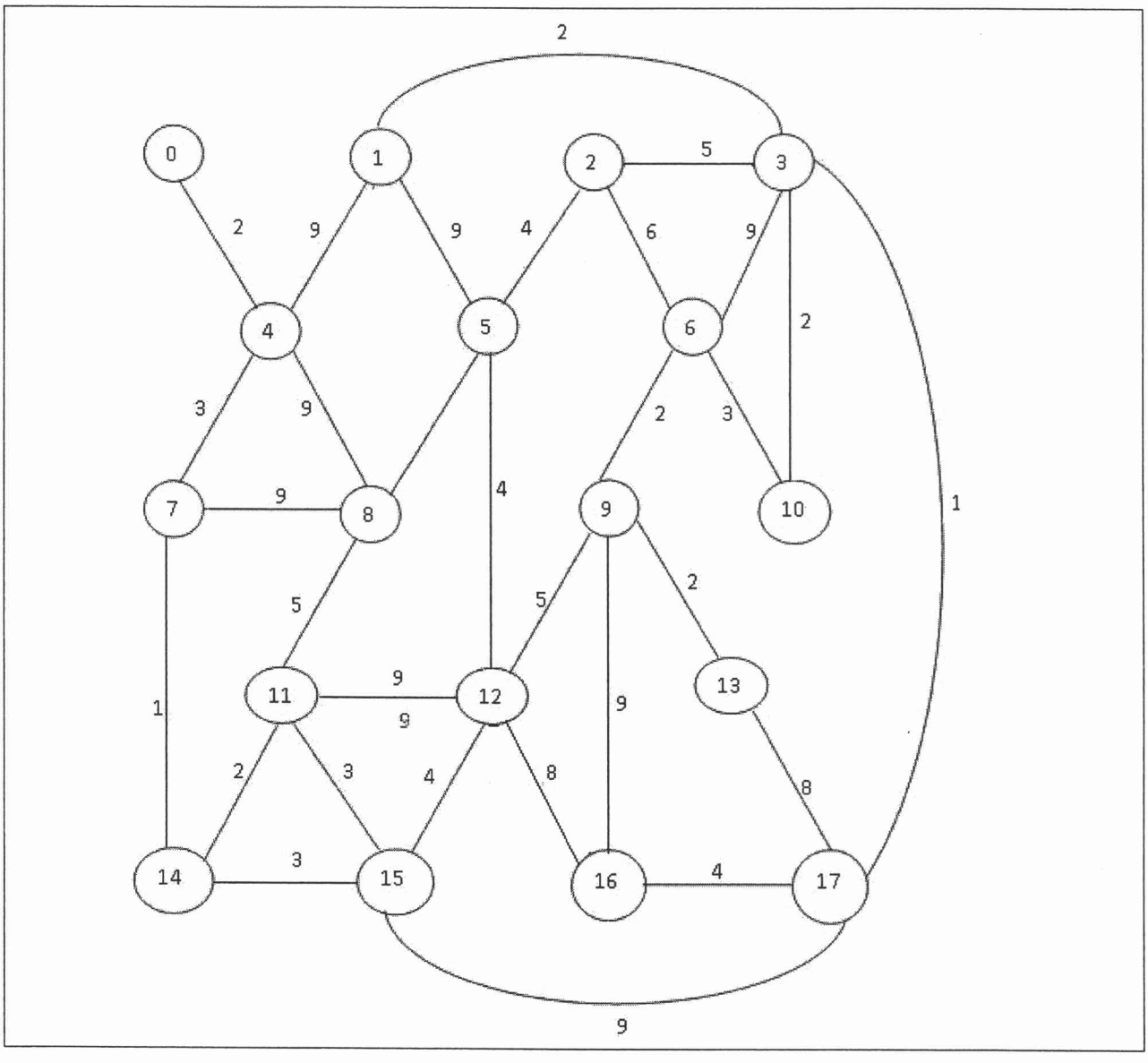

Figure Q5b

(10 marks)

END OF QUESTION PAPER