UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	DATA STRUCTURES AND ALGORITHMS
COURSE CODE	:	BEC 20602
PROGRAMME	:	BACHELOR OF ELECTRONIC ENGINEERING WITH HONOURS
EXAMINATION DATE	:	JUNE / JULY 2015
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Produce a complete C++ code to create a linked list node based on the diagram in FIGURE **Q1**.

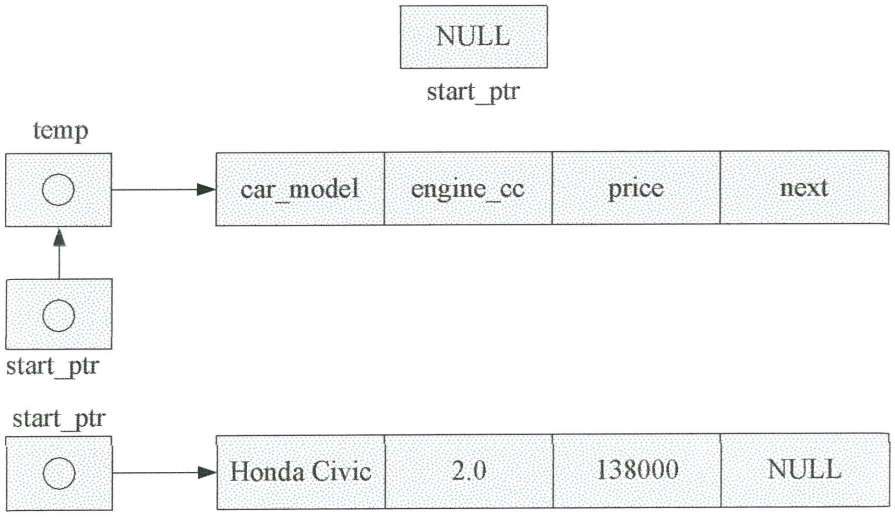

FIGURE Q1

(16 marks)

(b) Searching is a process of finding a particular element in an array. What is the best technique for searching a particular element in unsorted arrays? Recommend and explain the technique.

(4 marks)

Q2 (a) Abstract Data Type (ADT) can be divided into two classes: built-in ADT and user-defined ADT. State the values and operations of the following ADTs.

(i) Boolean

(2 marks)

(ii) Queue

(2 marks)

(b) Illustrate a diagram for the following data structure.

(i) Tree

(1 mark)

(ii) Graph

(1 mark)

(c) Inspect the following algorithm and then determine the total number of primitive operations, the total cost of execution time and the Big-Oh notations.

(i)
```
Algorithm printArray(A, n){
i =0;
while (i < n)
        cout << A[i] << endl;
i ++; }
```

(7 marks)

(ii)
```
Algorithm sum(n){
for (i=1; i<=n; i++) {
        for (j=1; j<=n; j++){
                sum = sum + i;
                j = j + 1;}
```

(7 marks)

Q3 (a) Analyse the following code then determine the content of stack A and queue B by drawing a diagram of stack A and queue B.

```
push(A, 3);
push(A, 12);
enqueue(B, 5);
enqueue(B, 8);
pop(A, x);
push(A, 2);
enqueue(B, x);
dequeue(B, x);
dequeue(B, y);
push(A, x);
push(A, y);
```

(5 marks)

(b) Recursion is a method of programming whereby a function directly or indirectly calls itself.

(i) Create a C++ code of linear recursion function named factorial.

(5 marks)

(ii) Identify the type of recursion of the following C++ code and describe it.

```
int is_even (unsigned int n){
        if (n = = 0) return 1;
        else return (is_odd (n-1));}
int is_odd (unsigned int n){
        return (!is_even(n));}
```

(2 marks)

(c) A queue is a linear list. Data can be inserted at one end (rear) and deleted from the other end (front).

(i) List two types of queue implementation.

(2 marks)

(ii) Draw a memory snapshot to represent the program output in FIGURE **Q3**.

```
####Display Queue####
The Elements In Queue Are

front_ptr :00491E80    back_ptr :00491B40

Node :1 Name :Ali      CGPA :2.7 cursor-next:00491B90
Node :2 Name :Abu      CGPA :3.5 cursor-next:00491B40
Node :3 Name :Anis     CGPA :3.2 cursor-next:00000000
```

FIGURE Q3

(6 marks)

Q4 (a) Given the following integer list:

10	23	2	12	34
a[0]	a[1]	a[2]	a[3]	a[4]

Show a trace (step by step) for each execution of Bubble Sort based on the following algorithm.

```
for (pass = 1 ; pass<= n ; pass++)          //passes
      for (i = 0 ; i<=n-2 ; i++)            //one pass
            if (a[i] > a[i+1]) {            //one comparison
                  hold = a[i];              //one swap
                  a[i] = a[i+1];
                  a[i+1] = hold; }
```

(6 marks)

(b) Given the following data:

19 90 25 12 30 43 6

(i) Draw a binary search tree.

(3 marks)

(ii) Construct the number of the binary search tree in **Q4 (b) (i)** using inorder, preorder and postorder traversal.

(3 marks)

(c) State the answer of (i) to (viii) based on FIGURE **Q4**.

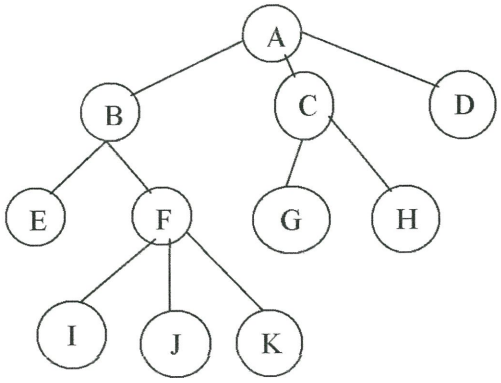

FIGURE Q4

(i) Number of nodes
(ii) Height of tree
(iii) Depth of F
(iv) External nodes
(v) Internal nodes
(vi) Ancestors of J
(vii) Descendants of B
(viii) Siblings of J

(8 marks)

Q5 (a) Show the resulting heap after each of the following alterations is made consecutively to the Heap object in FIGURE **Q5 (a)**.

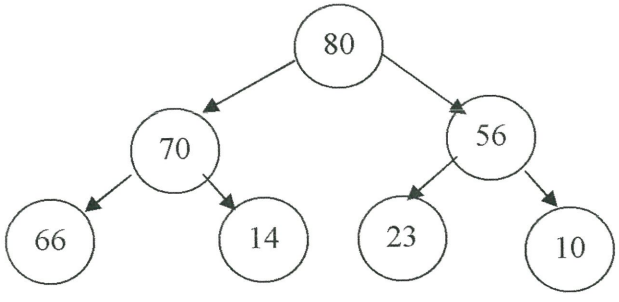

FIGURE Q5 (a)

(i) Add node 84

(2 marks)

(ii) Delete a maximum number

(3 marks)

(b) Examine the shortest path from node A to all nodes in FIGURE **Q5 (b)** using Dijkstra's algorithm. Provide table and diagram for your answer.

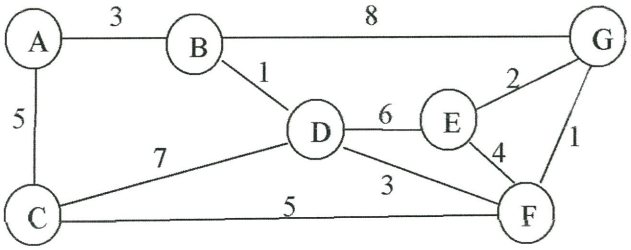

FIGURE Q5 (b)

(15 marks)

- END OF QUESTIONS -