Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 1
SESSION 2016/2017

COURSE NAME	:	DATA STRUCTURES AND ALGORITHM
COURSE CODE	:	BEC 20602
PROGRAMME CODE	:	BEJ / BEV
EXAMINATION DATE	:	DECEMBER 2016 / JANUARY 2017
DURATION	:	2 HOUR 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 Answer the following questions

(a) Consider the following code fragment and show how the steps to find the total operations of the algorithm given.

```
For(int i=0; i<n; i++) {
      for(int j=0; j<n*n; j++)
            sum = sum + I;
      for(int k=0; k<n+n; k++)
            a[k] = a[k] + sum;
}
```

(6 marks)

(b) What is the value of Big Oh for the statement below?

(i) Remove the value from a stack implemented as an array.

(2 marks)

(ii) Find the maximum value stored in a two dimensional array.

(2 marks)

(c) Consider the list below and answer the following questions

32 45 46 57 68 70 85

(i) By using Big Oh notation, determine the efficiency of the best case to find a particular item for the above list.

(2 marks)

(ii) Define the suitable search method for the list.

(2 marks)

(iii) Based on your answer in **Q1**(c)(ii), show the steps to determine total key comparison for searching an item "70" by fill in the table Q1(c)(iii).

(5 marks)

Table Q1(c) (iii)

Iteration	first	last	mid	List[mid]	Number of Comparisons
1	**0**	**6**	**3**	**57**	**2**
2					

(iv) What is the total key comparison?

(1 mark)

(d) Consider the following recursive method and draw a recursive tree for func(3)

```
int func (int j)
{
   if (j==1)
      return 1;

return 2*func (j-1) + 5*func(j-2);
}
```

(5 marks)

Q2 Consider the following linked list as illustrated in **Figure Q2**

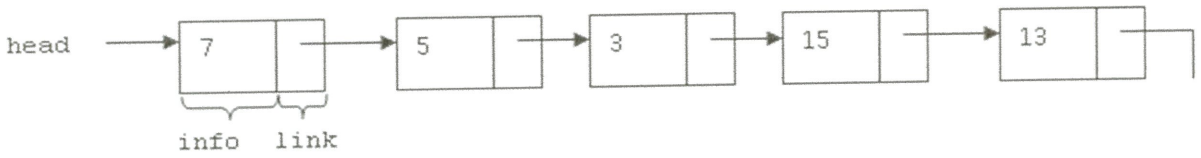

Figure Q2

The list contains five (5) nodes. The class Node has two attributes `info` and `link` where the info of type `int` and has `getInfo()`, `setInfo()`, `getLink()` and `setLink()` methods. The first node is pointed by `head`.

(a) Write a C++ code segment to create a new temporary pointer current of struct *Node* and set the current to point to the second node in the list. Then change the integer value in the second node from 5 to 9.

(4 marks)

(b) Complete the following iterative method `calculateTotal()`. The method will initialize the parameter current with reference of first node that always pointed by head. By using the current, the method begins with checking the list, the method will return zero (0) if the list is empty. Otherwise, if the list is not empty, it will continuously traverse all the entries and calculate the total of all integer values stored in the list then return the value.

(10 marks)

```
public int calculateTotal (Node current)
{


} // end calculateTotal()
```

(c) Complete the following recursive method `sequentialSearch()`. The method examines the list entry in the node that its parameter current references. If the entry is not matched with the target, the method will recursively call itself with an argument that references the next node in the linked list. If the list is empty, the method will return false otherwise true if found the target. Note: the call to the method `sequentialSearch()` initializes the parameter `current` to `head`.

(5 marks)

```
boolean sequentialSearch (Node current, int target)

{

} // end sequentialSearch()
```

(d) Give time efficiency of a sequential search for an unsorted linked list of n nodes. Explain your answer for each case.

i. Best Case
ii. Worst Case
iii. Average Case

(6 marks)

Q3 (a) Given the list in **Figure Q3 (a)**

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

Figure Q3 (a)

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; }
```


(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 **Q3 (b) (i)** using inorder, preorder and postorder traversal.

(3 marks)

(c) State the answer of (i) to (viii) based on **Figure Q3 (c)**.

(8 marks)

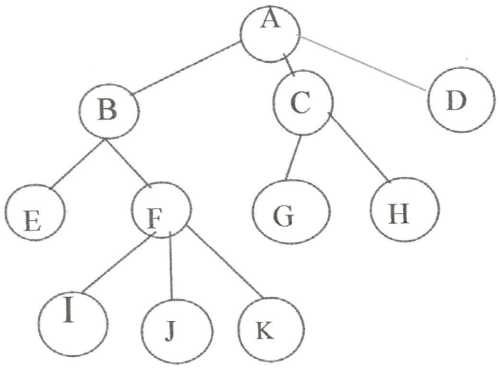

FIGURE Q3 (c)

(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

(d) Show the resulting heap after each of the following alterations is made consecutively to the Heap object in **Figure Q3 (d)**.

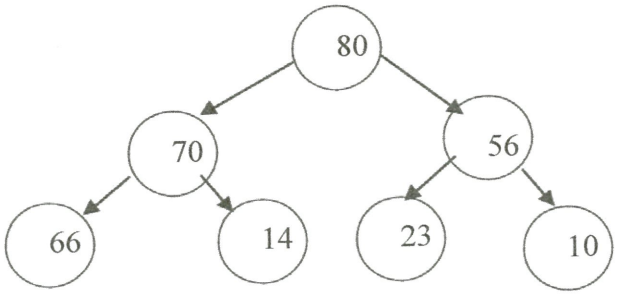

Figure Q3 (d)

(i) Add node 84

(2 marks)

(ii) Delete a maximum number

(3 marks)

Q4 (a) Examine the shortest path from node A to all nodes in **Figure Q4 (a)** using Dijkstra's algorithm. Provide table and diagram for your answer.

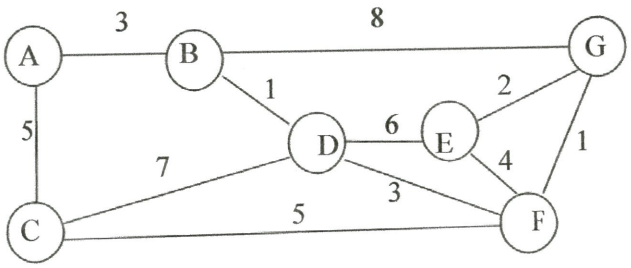

Figure Q4 (a)

(15 marks)

(b) Consider the following list of words:

apple, tree, car, dog, yellow, frog, gun, harp

(i) Alphabetize the above list using an insertion sort. Show your work.

(ii) Alphabetize the above list using a bubble sort. Show your work. How many complete passes are necessary for the bubble sort to ensure the list is sorted?

(10 Marks)

- **END OF QUESTIONS** -