UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	DATA STRUCTURE AND ALGORITHMS
COURSE CODE	:	BEC 20602
PROGRAMME	:	BEC
EXAMINATION DATE	:	JANUARY 2013
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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

Q1 (a) Illustrate an example of data structure for (i) to (v).

(i) linear list
(ii) matrix
(iii) tree
(iv) graph
(v) double linked list

(5 marks)

(b) Identify the big-Oh notation for algorithms in (i) to (iii).

(i)
```
int a = 1;
while (a<=n)
{
      statement 1;
      statement2;
      a++;
}
```

(ii)
```
for (i=0; i<n; i++)
      for (j=0; j<n; j++)
            for (k=0; k<n; k++)
                  statement1;
```

(iii)
```
for (i=1; i<=n; i*=2)
      for (j=1; j<i ; j++)
            statement1;
```

(6 marks)

(c) Arrange the keys shown below in an array with 19 elements using the two digits of fold shift method and then use modulo-division on the folded sum.

412525	301720	352035
651320	503420	485616
754208	221212	130310

(14 marks)

Q2 (a) Draw a memory snapshot to represent the program output below:

```
####Display Stack####

The Elements In Stack Are

top_ptr : 00491AE0

Node:3  Name:Anis       CGPA:3.2  cursor-next:00491B30
Node:2  Name:Abu        CGPA:3.5  cursor-next:00491E70
Node:1  Name:Ali        CGPA:2.7  cursor-next:00000000
```

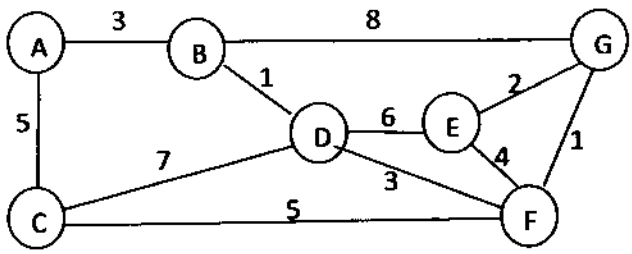
(5 marks)

(b) Investigate the content of stack A and queue B after the following code is executed.

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

(5 marks)

(c) Based on the following diagram:



Examine the shortest path from node A to all nodes using Dijkstra's algorithm.

(15 marks)

Q3 (a) Build a binary tree using the data below:

19 90 25 12 30 43 6

List the number using inorder, preorder and postorder traversal.

(5 marks)

(b) Given the following integer list:

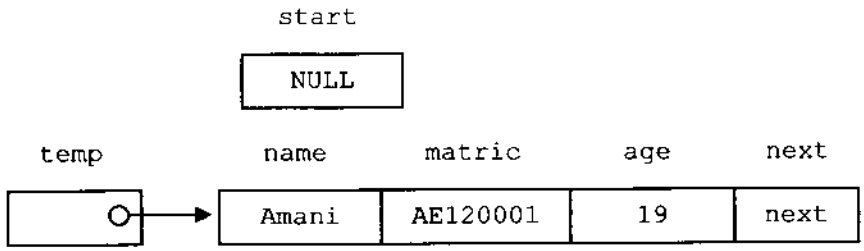
23	10	34	2	12
a[0]	a[1]	a[2]	a[3]	a[4]

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;
}
```

(8 marks)

(c) Based on structure below, write a function to add a node at head of linked list.



(12 marks)

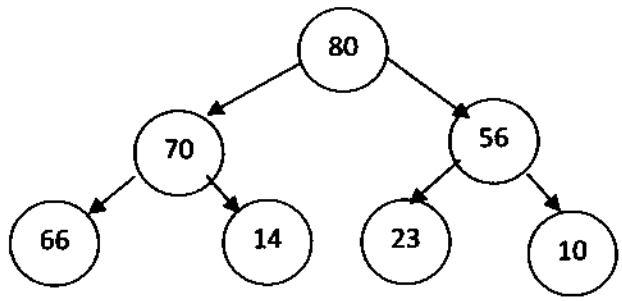
Q4 (a) Given a list of data in nodes:

30 20 10 60 40 50 90 7 35

Develop an AVL tree for the list above. Show each step in building the AVL tree.

(12 marks)

(b) Show the resulting heap after each of the following alterations is made consecutively to the following Heap object:



(i) Add node 84

(ii) Delete a maximum number

(8 marks)

(c) Convert the heap tree based on answer of Q4(b) as an array-based representation.

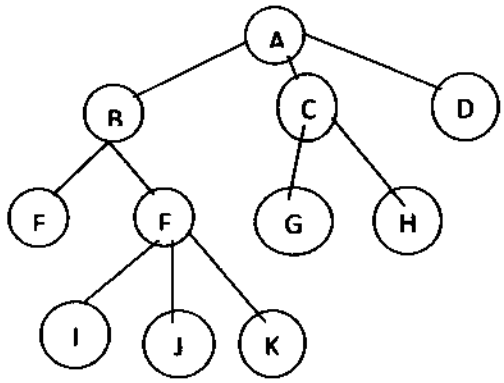
(5 marks)

Q5 (a) Order the following function by increasing growth rate.

$48n,\ n+n\log n,\ 2^n,\ n*n*n*n,1000$

(3 marks)

(b) Given the following diagram and answer (i) to (x).



State:

(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
(ix) Right subtree of C
(x) Degree of B

(10 marks)

(c) An array contains the elements shown below.

8 13 17 34 44 56 58 88 97

(i) Write an algorithm of binary search technique.

(ii) Trace the steps to find 88. At each iteration, show the contents of first, last and medium.

(12 marks)

- END OF QUESTION -