Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	DATA STRUCTURES AND ALGORITHMS
COURSE CODE	:	BEC 20602
PROGRAMME	:	BACHELOR OF ELECTRONIC ENGINEERING WITH HONOURS
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. ANSWER PART I USING OMR SHEET 3. ANSWER PART II IN ANSWER BOOKLET

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

PART I :

Q1 If ***h*** is any hashing function and is used to hash ***n*** keys in to a table of size ***m***, where ***n<=m***, distinguish the expected number of collisions involving a particular key ***x*** below :

A. less than 1.
B. less than n.
C. less than m.
D. less than n/2.

(1 mark)

Q2 Conclude what is the following code segment doing?

```
void fn(
){ char
c;
cin.get(
c);
 if (c != '\n') {
          fn();
          cout.put
          (c);
          }
 }
```

A. The string entered is printed as it is.
B. The string entered is printed in reverse order.
C. It will go in an infinite loop.
D. It will print an empty line.

(1 mark)

Q3 You have to sort a list L consisting of a sorted list followed by a few "random" elements. Determine which of the following sorting methods would be especially suitable for such task

A. Bubble sort
B. Selection sort
C. Quick sort
D. Insertion sort

(1 mark)

Q4 The conclude of B Trees are generally

A. very deep and narrow
B. very wide and shallow
C. very deep and very wide
D. cannot be concluded

(1 mark)

Q5 Determine a technique for direct search

A. Binary Search
B. Linear Search
C. Tree Search
D. Hashing

(1 mark)

Q6 If a node having two children is deleted from a binary tree, it is replaced by its

A. Inorder predecessor
B. Inorder successor
C. Preorder predecessor
D. None of the above

(1 mark)

Q7 Determine the searching technique that takes *O (1)* time to find a data.

A. Linear Search
B. Binary Search
C. Hashing
D. Tree Search

(1 mark)

Q8 A mathematical-model with a collection of operations defined on that model is called

A. Data Structure
B. Abstract Data Type
C. Primitive Data Type
D. Algorithm

(1 mark)

Q9 Use Bubble Sort to determine the number of interchanges required to sort 5, 1, 6, 2 4 in ascending order

A. 6
B. 5
C. 7
D. 8

(1 mark)

Q10 Determine the complexity of multiplying two matrices of order $m*n$ and $n*p$.

A. mnp
B. mp
C. mn
D. np

(1 mark)

Q11 By analyzing the following, in worst case Quick Sort has the order of

A. O (n log n)
B. O ($n^2/2$)
C. O (log n)
D. O ($n^2/4$)

(1 mark)

Q12 A binary tree in which if all its levels except possibly the last, have the maximum number of nodes and all the nodes at the last level appear as far left as possible, is known as

A. full binary tree.
B. AVL tree.
C. threaded tree.
D. complete binary tree.

(1 mark)

Q13 Detect a linear list of elements in which deletion can be done from one end (front) and insertion can take place only at the other end (rear) is known as a

A. queue.
B. stack.
C. tree.
D. linked list

(1 mark)

Q14 A sort, which relatively passes through a list to exchange the first element with any element less than it and then repeats with a new first element is called

A. insertion sort.
B. selection sort.
C. heap sort.
D. quick sort.

(1 mark)

Q15 Distinguish which of the following sorting algorithms does not have a worst case running time of $O(n^2)$?

A. Insertion sort
B. Merge sort
C. Quick sort
D. Bubble sort

(1 mark)

Q16 Consider a linked list of n elements. Evaluate what is the time taken to insert an element after an element pointed by some pointer?

A. O (1)
B. O ($\log_2$ n)
C. O (n)
D. O (n $\log_2$ n)

(1 mark)

Q17 The smallest element of an array's index is called its

A. lower bound
B. upper bound
C. range
D. extraction

(1 mark)

Q18 Determine a circular linked list

A. the components are all linked together in some sequential manner.
B. there is no beginning and no end.
C. the components are arranged hierarchically.
D. forward and backward traversals within the list are permitted.

(1 mark)

Q19 State the data structure required for Breadth First Traversal on a graph is
A. queue
B. stack
C. array
D. tree

(1 mark)

Q20 Distinguish the suitable answer. The quick sort algorithm exploit _____design technique

A. Greedy
B. Dynamic programming
C. Divide and Conquer
D. Backtracking

(1 mark)

PART II :

Q21 (a) 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 ++; }
```

(10 marks)

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

(10 marks)

Q22 (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 the corresponding 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) Provide the answer of (i) to (viii) based on **Figure Q22**.

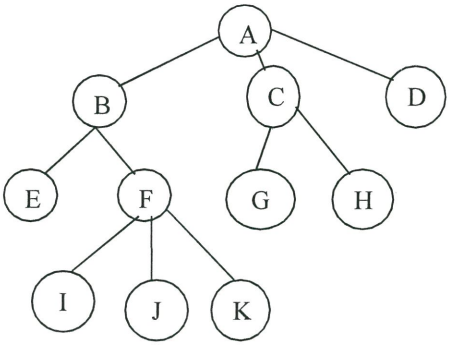

Figure Q22

(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)

Q23 (a) Show the resulting heap after each of the following alterations is made consecutively to the Heap object in **Figure Q5 (a).**

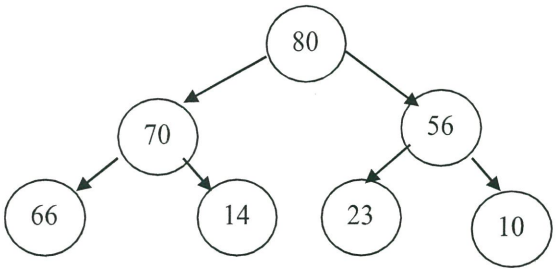

Figure Q23 (a)

(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 Q23 (b)** using Dijkstra's algorithm. Provide table and diagram for your answer.

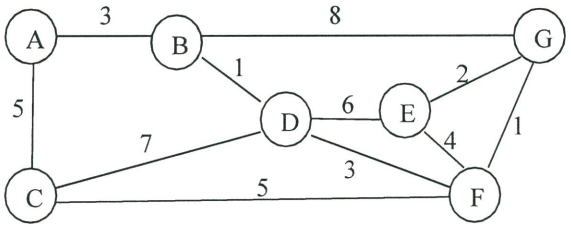

Figure Q23 (b)

(15 marks)

- END OF QUESTIONS -