

招生學年度	104	招生類別	碩士班
系所班別	資訊工程學系碩士班 (資工甲組)		
科目名稱	資料結構		
注意事項	本考科禁止使用掌上型計算機		

- 1 (15%) Given a tree as shown in Figure 1, please answer the following questions:
 - 1.1 What is height of this tree?
 - 1.2 List all leaf nodes?
 - 1.3 List all subtrees of node "Jon"?
 - 1.4 Write down siblings of node "Phil"?
 - 1.5 What is the degree of this tree?

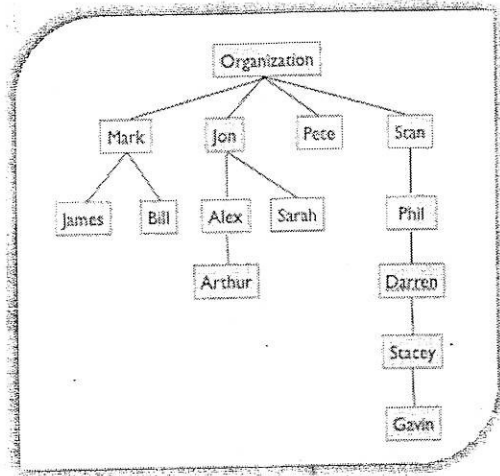


Figure 1 A sample tree structure

- 2 (5%) Please specify the main purpose of the member function: `classNameFunction()` based on the given cpp code snippets.

```

className::className(const className& s)
{
    root = classNameFunction(s.root);
}

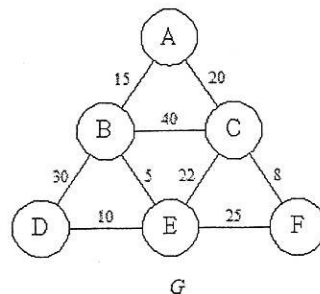
Node* className::classNameFunction(Node *argNode)
{
    if (argNode) {
        Node *temp = new Node;
        temp->data = argNode ->data;
        temp->LeftChild = classNameFunction(argNode ->LeftChild);
        temp->RightChild = classNameFunction(argNode ->RightChild);
        return temp;
    }
    else return 0;
}
    
```

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- 3 (15%) An ADT of Queue is as follows. Please implement `Queue<T>::Push(const T& item)` member function using C++ programming language.

```
template < class T >
class Queue
{
public:
    Queue (int queueCapacity = 0);
    bool IsEmpty () const;
    T& Front () const;
    T& Rear () const;
    void Push (const T& item); // Insert item at the rear of the queue
    void Pop (); // Delete the front element of the queue
};
```

- 4 (5%) Declare an array `a[20][30]`, what is the number of elements for `a[15][22]`?
- 5 (10%) In time complexity analysis for algorithms, there are algorithms with logarithmic time ($\log n$), linear time (n), quadratic time (n^2), exponential time (2^n), etc. please illustrate these time complexity using a graph with x-axis representing the number of input, say $n=0, 1, 2, \dots, 10$ and y-axis representing the computation time.
- 6 Construct the minimum cost spanning tree for the following weighted graph G .
- 6-1 (10%) Write a Kruskal's algorithm to find the Minimum Spanning Tree of a graph G .
- 6-2 (5%) Write out each weight of the edges added to the tree in the sequence of applying Kruskal's algorithm.



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7 (15%) Please write down the following sorting of running time used by big-O (ex. $O(n)$).

	best case	average case	worst case
insertion sort			
Merge sort			
quick sort			
Heap sort			
radix sort			

8 (10%) Demonstrate the insertion of the keys 12, 5, 88, 128, 17, 10, 33, 45, 27, 14, 64 and 129 into a hash table with collision resolved by linear probing. Make 13 slots in the table, and let the hash function be $h(k) = k \text{ mod } 13$.

9 (10%) Stable sorting

9-1 What is a stable sorting algorithm?

9-2 indicate which of the following sorting algorithm are stable:

Insertion sort, bubble sort, quick sort, heap sort, and merge sort.