CSE 3010 – Data Structures & Algorithms

Lecture #33

What will be covered today

- Operations on a binary tree
- Representation of a binary tree in C
- Traversing a binary tree
- Introduction to binary search tree

Specific operations on binary tree

`createBinaryTree()`	Create an empty binary tree
`hasLeftChild(node)`	Return if the given `node` has a left child
`hasRightChild(node)`	Return if the given `node` has a right child
`isLeftChild(node)`	Return if the given `node` is a left child
`isRightChild(node)`	Return if the given `node` is a right child
`insertLeft(node,element)`	Insert the `element` as the left child of the `node`
`insertRight(node,element)`	Insert the `element` as the left child of the `node`
`remove(element)`	Remove the `element` from the tree

Representation of a binary tree in C

```
typedef int ITEM;
// Node in a binary tree without a pointer
to a parent node
typedef struct node {
    ITEM key;
    struct node *left;
    struct node *right;
} BSTNODE
```

Connecting nodes with its left and right nodes gives the binary tree

Representation of a binary tree in C

```
typedef int ITEM;
// Node in a binary tree with a pointer to
a parent node
typedef struct node {
      ITEM key;
      struct node *left;
      struct node *right;
      struct node *parent;
} BSTNODE
```

Traversing a binary tree

- Three methods
  - In order traversal
    - Left node, root node, right node
  - Pre order traversal
    - Root node, left node, right node
  - Post order traversal
    - Left node, right node, root node

Binary search tree

- Search tree is a tree data structure used for finding a key in the input dataset
- For a search tree key for each node must be:
  - Greater than any keys in the sub trees on the left
  - Less than any keys in any of the sub trees on the right
- Binary Search Tree is a tree in which following properties hold true for all nodes
  - Left sub tree of a node has a key less than or equal to its parent node's key
  - Right sub-tree of a node has a key greater than to its parent node's key

Binary search tree - Examples