Faculty of Engineering and Applied Science

SOFE - 3950U Operating Systems

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Tutorial 8 - Signals and Data Structures Part 2

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Github: https://github.com/23Vishan/OS-Tutorial-6

For Code and Screenshots of Program Execution

1. **What is an Abstract Data Type (ADT)?**

An ADT is a type/class that is defined by a set of operations/values and is used for objects. An ADT allows us to express data for abstract members and behaviors.

2. **Explain the difference between a queue (FIFO) and a stack (LIFO)**

For FIFO, it uses the function “push” to add the first node, while the function “pop” will take out the same node first. For stack (FILO), they use the functions in a different way. “Push” does the same thing as it will add the first node, however when “pop” is used, that same first node is now taken out last.

3. **Name and briefly explain three types of data structures.**

Three types are a tree, a linked list, and a heap.

Types	Explanation
Tree	A tree uses a more hierarchical structure for data and to connect nodes together. The highest node is called the root node while the nodes underneath are called parent or child nodes. A node can be called a parent node if it has nodes connected underneath it. The nodes underneath can be referred to as child nodes. Each parent node can have many child nodes.
Linked List	A linear data structure that uses pointers in order to link the elements. The elements that are connected are usually nodes that store both data and the address of the upcoming node.
Heap	A heap is a specialized type of tree.In a heap, there are two types, a max-heap and a min-heap. For a max heap, the root node must be greater than all the child nodes, while for a min heap, the root node must be smaller than all of the child nodes. Another rule is that for any child nodes, they have to start from the left side and then go to the right.

4. **Explain what a binary tree is, what are some common operations of a binary tree?**

A binary is a tree type data structure, in which parent nodes have at least 2 children(left and right nodes). The value of the left node should be less than the parent node and the value inside the parent node should be less than the right node.

Operations of Binary tree:

1. Insert - this operation is use to insert element to the tree or create a new tree
2. Search - this operation is used to search a given element/node in the tree.
3. Pre Order Transversal: this operation is used to traverse the tree in a preorder manner.
4. Inorder Transversal: this operation is used to transverse the tree in an inorder manner.
5. Post order transversal : this operation is used to transverse the tree in a postorder manner.

5. **Explain what a hash table (dictionary) is, what are common operations of a hash table?**

A hash table or sometimes called a hash map, is a data structure technique that involves the mapping of values with keys. Keys are integers that are used for indexing and the values are the data that is set for the keys. For hash tables, the values are not placed in a sorted order and you have to be aware of any collisions that may occur. For a hash table, there is a process called hashing. Hashing is when new indexes are created using the keys. After the index is created, the element that is meant for the key is stored inside it. Some hash functions that you can use are division method, multiplication method, and universal hashing.