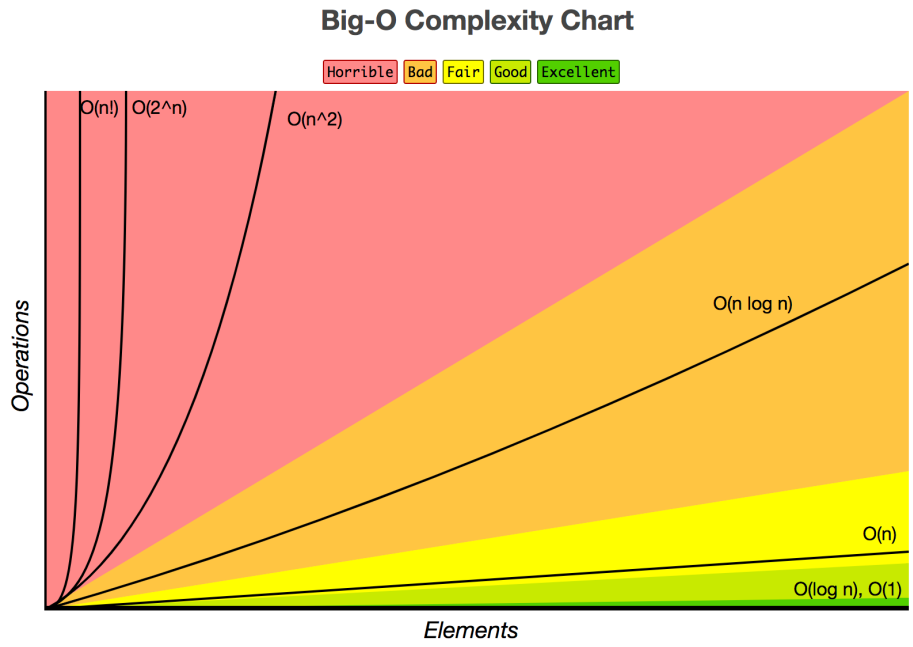
Algorithms/Data Structures/Strategies

Big O Notation



Linked Lists

- sequence of nodes where each node stores its own data and a link to the next node
- first node is called the **head**
- last node must have its link pointing to **None**

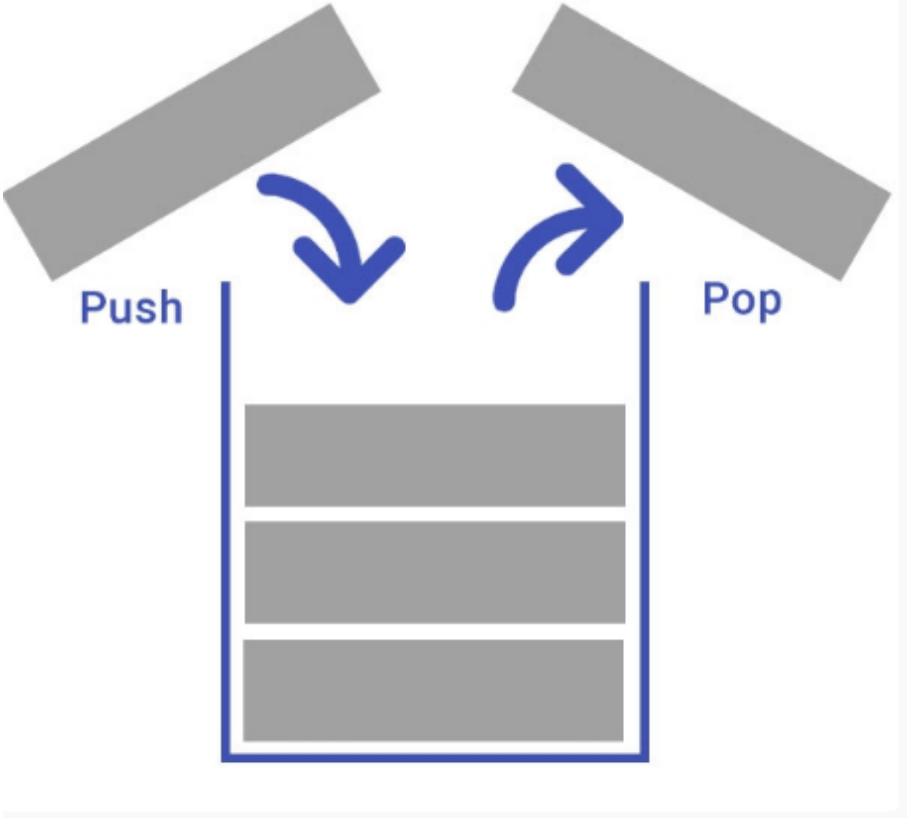

```
class Node:
    def __init__(self, data, next):
        self.data = data
        self.next = next

class LinkedList:
    def __init__(self):
        self.head = None

    def add_at_front(self, data):
        self.head = Node(data, self.head)

    def add_at_end(self, data):
        if not self.head:
            self.head = Node(data, None)
            return
        curr = self.head
        while curr.next:
            curr = curr.next
        curr.next = Node(data, None)

    def get_last_node(self):
        n = self.head
        while(n.next != None):
            n = n.next
        return n.data

    def is_empty(self):
        return self.head == None

    def print_list(self):
        n = self.head
        while n != None:
            print(n.data, end = " => ")
```

```
            n = n.next
        print()
```

Stacks and Queues

Stacks

- LIFO - Last In First Out

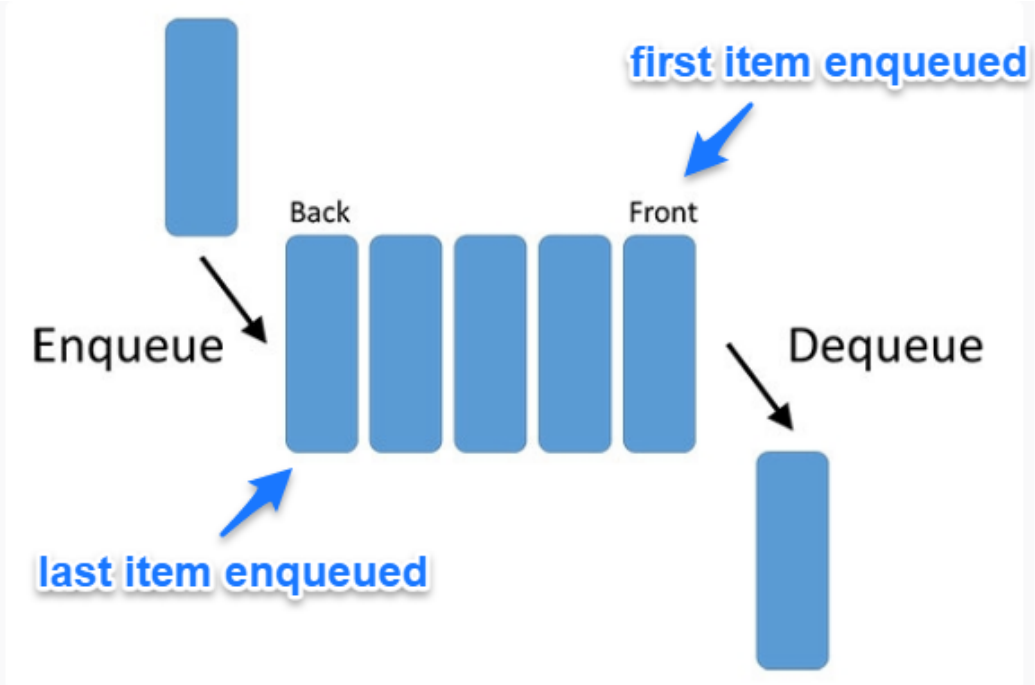



```
class Stack:
    def __init__(self):
        self.items = []

    def is_empty(self):
```

```
        return self.items == []

    def push(self, item):
        self.items.insert(0, item)

    def pop(self):
        return self.items.pop(0)

    def print_stack(self):
        print(self.items)
```

Queue

- FIFO - First In First Out




```
class Queue:
    def __init__(self):
        self.items = []
    def is_empty(self):
        return self.items == []
```

```
    def enqueue(self, item):
        self.items.insert(0, item)
    def dequeue(self):
        return self.items.pop()
    def print_queue(self):
        print(self.items)
```

Hash Tables

https://www.youtube.com/watch?v=shs0KM3wKv8&ab_channel=HackerRank

Hashtable -> key/value lookup

get a key and associate a value to look easily the data associated

image.png 442 kB

how to jump from string to index - hash function

1. takes a string
2. convert string into int
3. converts int to an index in the array

Binary Trees:

https://www.youtube.com/watch?v=6oL-0...

- trees are a way of path
- nodes are the points and the roots are the origin
- 3 types of traversals:
  - pre-order: Root>Left Tree>Right Tree
  - in-order:Left Tree>Root>Righ Tree
  - post-order:Left Tree>Right Tree>Root

```
class Node:
    def __init__(self, value):
        self.value = value
        self.left = None
        self.right = None

class BinaryTree(Node):
    def __init__(self, root):
        self.root = Node(root)

    def print_tree(self, traversal_type):
        if traversal_type == 'preorder':
            return self.preorder_print(tree.root, '')

        elif traversal_type == 'inorder':
            return self.inorder_print(tree.root, '')

        elif traversal_type == 'postorder':
           return self.postorder_print(tree.root, '')

        else:
            print("traversal type " + str(traversal_type) + "not supported")
            return False


    def preorder_print(self, start, traversal):
        # Root>Left Tree>Right Tree
        if start:
            traversal += (str(start.value) + '-')
            traversal = self.preorder_print(start.left, traversal)
            traversal = self.preorder_print(start.right, traversal)

        return traversal
```

```
    def inorder_print(self, start, traversal):
        # Left Tree>Root>Right Tree
        if start:
            traversal = self.inorder_print(start.left, traversal)
            traversal += (str(start.value) + '-')
            traversal = self.inorder_print(start.right, traversal)

        return traversal

    def postorder_print(self, start, traversal):
        # Left Tree>Right Tree>Root
        if start:

            traversal = self.postorder_print(start.left, traversal)
            traversal = self.postorder_print(start.right, traversal)
            traversal += (str(start.value) + '-')

        return traversal

"""
Tree Scheme
                1
              /       \
        2              3
    /       \       /     \
  4          5    6         7
                                \
                                  8
"""

tree = BinaryTree(1)
tree.root.left = Node(2)
tree.root.right = Node(3)

tree.root.left.left = Node(4)
tree.root.left.right = Node(5)
tree.root.right.left = Node(6)
tree.root.right.right = Node(7)

tree.root.right.right.right = Node(8)

print(tree.print_tree('preorder'))
```

```
print(tree.print_tree('inorder'))
print(tree.print_tree('postorder'))
```

Depth First Search

https://www.youtube.com/watch?v=Sbcii...

dsdas
dsa
das

Breadth FIrst Search

dss