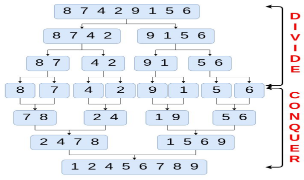
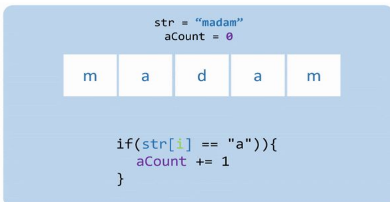
problem solving patterns

-- ***divide and conquer*** - divide in half, initialize a min max then move the pointer until the result is found.

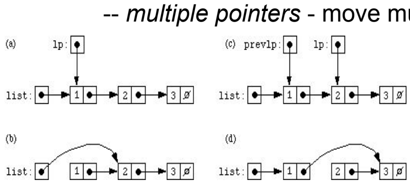


Merge Sort

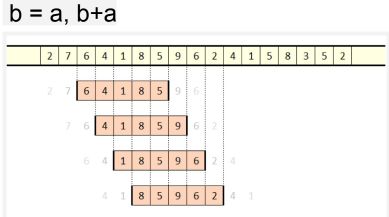
-- ***frequency counter*** - making object counters then compare them. i.e. anagrams -> {a: 0, n: 0, g: 0, r: 0, m: 0,s:1}



-- *multiple pointers* - move multiple pointers. arr[i], arr[j]

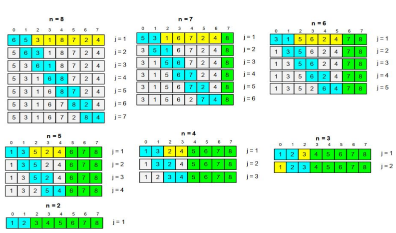


-- ***sliding windows*** - create temporary variable then update it according to logic. i.e. temp_var = max_var or a,
b = a, b+a

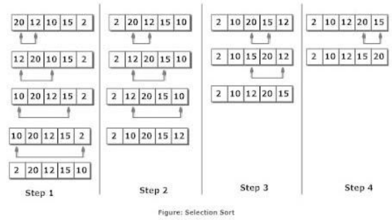


search algo

bubble sort -- brute force, comparing current and next element linearly

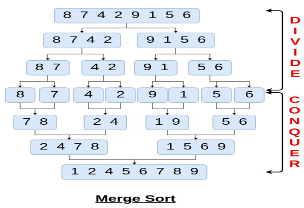


selection sort - compare current element to next then move the pointer to the next then compare again and so on..

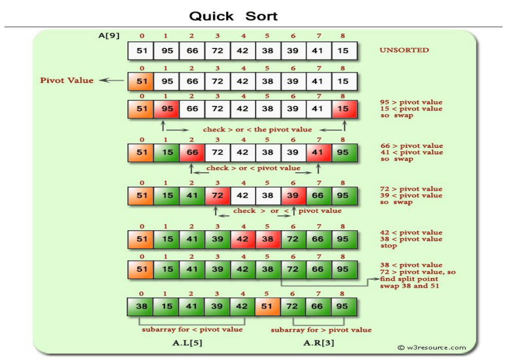


Advanced sorting:

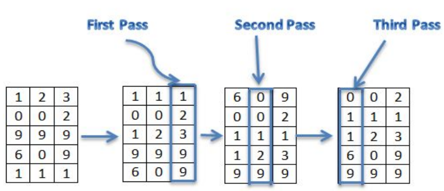
merge sort - divide array in half until there's one element per array then compare the next array element then merge them



quick sort - pick any element(use pivot helper) then find all element that are less than it, put it to the left then greater than elements to the right, repeat. Pivot helper --where the rest of the sorted element will depend



radix sort - looking at the digit from the right then group them in every element bucket and



data structures

singly linked list - object consists of head and tail node with next attribute node and a tail that has a next attribute of null.

-- SinglyLinkedList {head: Node { val: 100, next: Node { val: 201, next: [Node] } },
tail: Node { val: 999, next: null }, length: 5}

doubly linked list - object consist of head and tail node with next and prev attribute node and a tail that has a next attribute of null

-- DoublyLinkedList { head: Node { val: 'Harry', next: Node { val: 'Ron', next: [Node], prev: [Circular] },
prev: null }, tail: Node {val: 'Hermione', next: null, prev: Node { val: 'Ron', next: [Circular],
prev: [Node] } }, length: 3 }

stacks - FILO

```
-- Stack {
  first: Node { value: 3, next: Node { value: 2, next: [Node] } },
  last: Node { value: 1, next: null },
  size: 3}
```

queues - FIFO

```
-- Queue {
  first: Node { value: 1, next: Node { value: 2, next: [Node] } },
  last: Node { value: 3, next: null },
  size: 3}
```

binary search tree - parents nodes are greater than children, left child is always less than th parent and right are greater than the parent

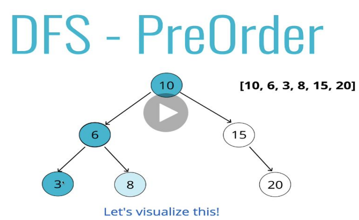
```
-- BinarySearchTree {
  root: Node {
    value: 10,
    left: Node { value: 5, left: [Node], right: [Node] },
    right: Node { value: 13, left: [Node], right: [Node] }
  }
}
```

tree traversal bfs - searching the tree per each row, from left to right

```
--data [ 10, 6, 15, 3, 8, 20 ]
BinarySearchTree {
  root: Node {
    value: 10,
    left: Node { value: 6, left: [Node], right: [Node] },
    right: Node { value: 15, left: null, right: [Node] }
  }
}
```

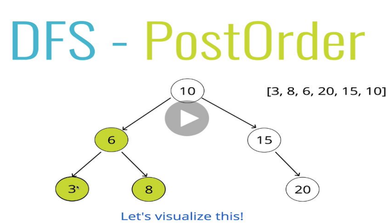
tree traversal dfs preorder - traverse from root to the deepest child then its parent then the deepest child and so on.

```
data [ 10, 6, 15, 3, 8, 20 ]
BinarySearchTree {
  root: Node {
    value: 10,
    left: Node { value: 6, left: [Node], right: [Node] },
    right: Node { value: 15, left: null, right: [Node] }
  }
}
```



tree traversal dfs postorder - traverse from the deepest child then its parent then the deepest child and so on

```
data [ 3, 8, 6, 20, 15, 10 ]
BinarySearchTree {
  root: Node {
    value: 10,
    left: Node { value: 6, left: [Node], right: [Node] },
    right: Node { value: 15, left: null, right: [Node] }
  }
}
```

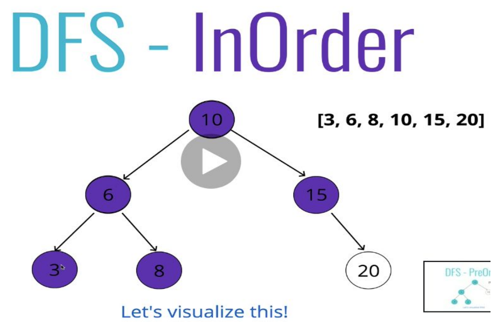


tree traversal dfs preorder - traverse the deepest child, sibling then its parent then the child and so on

```
data [ 3, 6, 8, 10, 15, 20 ]
BinarySearchTree {
  root: Node {
    value: 10,
    left: Node { value: 6, left: [Node], right: [Node] },
    right: Node { value: 15, left: null, right: [Node] }
  }
}
```

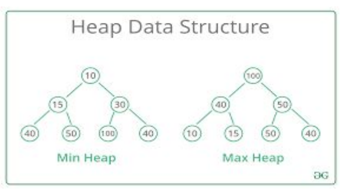
```
data [ 3, 8, 6, 20, 15, 10 ]
BinarySearchTree {
  root: Node {
```

    value: 10,
    left: Node { value: 6, left: [Node], right: [Node] },
    right: Node { value: 15, left: null, right: [Node] }
  }
}



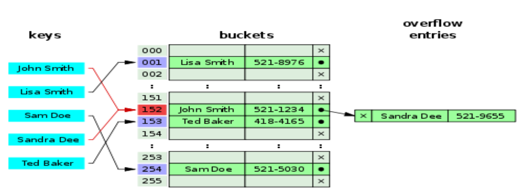
binary heaps - maxbh-> parents > children, minbh -> parents < children, no order for children

MaxBinaryHeap { values: [
  55, 39, 41, 18,
  27, 12, 33
 ] }



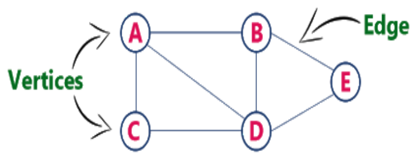
hash table/maps - used to store key value pairs

HashTable {
 keyMap: [
  [['plum', '#DDA0DD']],
  <2 empty items>,
  [['salmon', '#FA8072']],
  [['violet', '#DDA0DD']],
  <2 empty items>,
  [['purple', '#DDA0DD']],
  [['maroon', '#800000'], ['yellow', '#FFFF00']],
  <1 empty item>,
  [['olive', '#808000']],
  <2 empty items>,
  [['lightcoral', '#F08080']],
  <2 empty items>,
  [['mediumvioletred', '#C71585']]
 ]
}

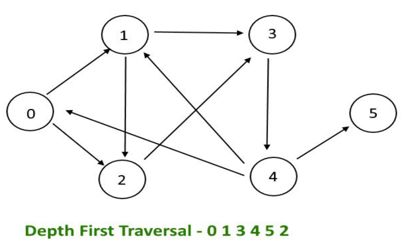


graph - consists of vertices(nodes) and edges

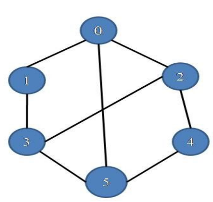
```
let g = new Graph();
g.addVertex("Dallas");
g.addVertex("Tokyo");
g.addVertex("Aspen");
g.addVertex("Los Angeles");
g.addVertex("Hong Kong");
g.addEdge("Dallas", "Tokyo");
g.addEdge("Dallas", "Aspen");
g.addEdge("Hong Kong", "Tokyo");
g.addEdge("Hong Kong", "Dallas");
g.addEdge("Los Angeles", "Hong Kong");
g.addEdge("Los Angeles", "Aspen");
Graph {
  adjacencyList: {
    Dallas: [ 'Tokyo', 'Aspen', 'Hong Kong' ],
    Tokyo: [ 'Dallas', 'Hong Kong' ],
    Aspen: [ 'Dallas', 'Los Angeles' ],
    'Los Angeles': [ 'Hong Kong', 'Aspen' ],
    'Hong Kong': [ 'Tokyo', 'Dallas', 'Los Angeles' ]
  }
}
```



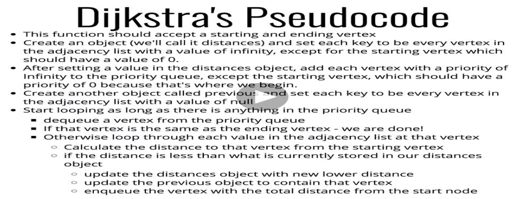
graph dfs - traverse through the deepest line then again on the next child



graph bfs - traverse through all children then the children of the next children

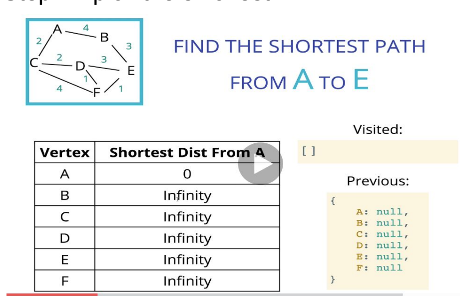


djikstra - shortest way to travel from a path to another

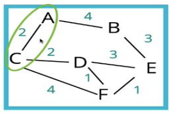



```
WeightedGraph {
 adjacencyList: {
  A: [ { node: 'B', weight: 4 }, { node: 'C', weight: 2 } ],
  B: [ { node: 'A', weight: 4 }, { node: 'E', weight: 3 } ],
  C: [
   { node: 'A', weight: 2 },
   { node: 'D', weight: 2 },
   { node: 'F', weight: 4 }
  ],
  D: [
   { node: 'C', weight: 2 },
   { node: 'E', weight: 3 },
   { node: 'F', weight: 1 }
  ],
  E: [
   { node: 'B', weight: 3 },
   { node: 'D', weight: 3 },
   { node: 'F', weight: 1 }
  ],
  F: [
   { node: 'C', weight: 4 },
   { node: 'D', weight: 1 },
   { node: 'E', weight: 1 }
  ]
 }
}
[ 'A', 'C', 'D', 'F', 'E' ]
```

Step1: - pick the smallest



Step 2 - look at each of its neighbors then repeat on all its children



FIND THE SHORTEST PATH

FROM A TO E

Pick The Smallest...A

Vertex	Shortest Dist From A
A	0
B	~~Infinity~~,4
C	Infinity
D	Infinity
E	Infinity
F	Infinity

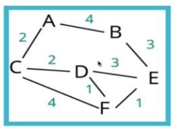
Visited:

```
[A]
```

Previous:

```
{
    A: null,
    B: A,
    C: null,
    D: null,
    E: null,
    F: null
}
```

Step 3 - look at the distance in the end



FIND THE SHORTEST PATH

FROM A TO E

Pick The Smallest...E

Vertex	Shortest Dist From A
~~A~~	0
~~B~~	~~Infinity~~,4
~~C~~	~~Infinity~~,2
~~D~~	~~Infinity~~,4
E	~~Infinity~~,~~7~~,6
~~F~~	~~Infinity~~,5

Visited:

```
[A,C,B,D]
```

Previous:

```
{
    A: null,
    B: A,
    C: A,
    D: C,
    E: F,
    F: D
}
```