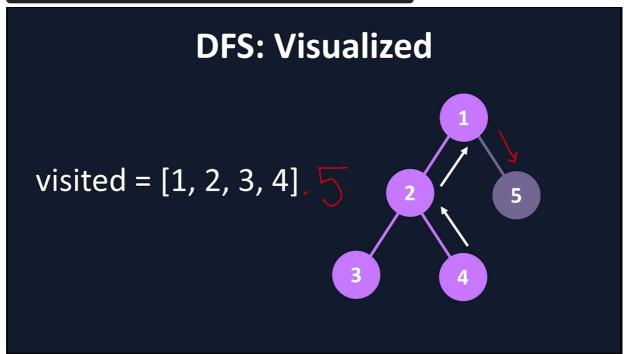
Overview of important Algorithms

- Searching
 - Binary Search
 - Depth First Search for trees and graphs
 - start from the top of a tree and go as deep as possible along the same branch
 - once you are at the bottom then go to nearest unvisited node usually a sibling of the deepest node
 - this process is called Backtracking
 - used to solve a maze
 - 0(number of nodes + number of branches)



- Breadth First Search for trees and graphs
 - you don't go to deepest point like DFS
 - instead you make sure that the sibling node has been visited
 - once you are on a node look at its children and add them to a queue and then you visit the node in the queue and add them to visited array and remove them from sibling queue
 - if the node in the queues has more children then add them to queue when marking it visited
 - used in chess
 - O(number of nodes + number of branches)
- Sorting

- Insertion Sort
 - compares the nth element with (n+1)th element and swaps them if nth element is larger
 - best case O(n) if everything is already sorted
 - worst case $O(n^2)$ when nothing is sorted beforehand

Merge Sort

- divide and conquer and conquer by divide and conquer and so on
- recursion
- splits array in half till we have pairs of 2
- then all pairs of 2 are sorted and then 2 pairs of 2 are merged and sorted till the array is completely merged back again
- best and worst case are same O(n log n)

Quick Sort

- recursive like merge sort so divides and conquers
- we choose a pivot element of the array which is closest to the median of the array elements
- then we split the lists into 2 such that one list has elements less than the pivot element and one where all elements are greater than the pivot element
- we repeat the same on these 2 lists
- we move the pivot element to the end of the list
- we place 2 pointers one on the 0th index and the 2nd on the 2nd last element and compare the two if the 0th one is larger we swap
- deep doing it till the 2 pointers meet
- when they meet replace that element with the last one
- we know have 2 lists like we wanted and we can do the same thing on them individually
- best case 0(n log n)
- worst case 0(n^2)
- still can be 2 to 3 times faster than merge sort by reducing the chances of worst case
- needs less memory O(log n) than merge sort O(n)

Greedy Algorithm

- It makes the best possible decision at every local step
- when not to be greedy
 - not meant for efficiency

- when to be greedy
 - when you don't want to find the most efficient way out of millions of permutations then greedy might be a good enough solution
 - when optimal solution not possible and brute force is not acceptable become greedy