Laboratory practice No. 2: Brute Force or Exhaustive Search

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3) Practice for final project defense presentation

3.1 Our algorithm starts by finding all possible permutations (without repetition) given an array of elements. In this step we do not include the source because we know that said vertex will be visited at the start and at the end of the circuit, this assumption does not pose a problem because the graph is complete. We then compute the cost of each one of the circuits found and choose the least expensive one.

3.2 O((V-1)!)
The reason this algorithm is O((V-1)!) is that instead of generating all permutations of vertices we exclude the source vertex thus there are (V-1)! Circuits from which we must choose the cheapest one.

3.3 A graph with 50 vertices would produce 49! permutations, that is circuits. We don't have to compute the time it will take the algorithm to run all other operations, like compute the cost of a circuit or run other auxiliary functions, to know that the brute force algorithm is not applicable to a graph this large.

3.4 We used a list of pairs to represent the holes in the board and in order to make it more efficient we implemented an one-dimensional array instead of a matrix and instead of check the whole board we just review the plays made using Backtracking.

3.5 n^2 because we have a loop and inside of it is an if conditional with a total complexity of O(n). So we have O(n)xO(n) = O(n^2).

3.6 N represents the size of the array.

4) Practice for midterms

4.1 Maximum subarray

4.1.1 actual<máximo

4.1.2 O(n^2) ,n is the number of elements of the array

4.2 Sorting

4.2.1 ordenar(arr,k+1);
4.2.2 O(n!) , n is the number of elements of the array

4.3 Search string within a string

4.3.1 if (j == m) return i-pat.length();// encontrado
4.3.2 else return txt.length(); // no encontrado
4.3.3 O(n) ,where n is the number of characters of the text
this happens when the pattern is not in the text

4.4

4.4.1
4.4.2 b. *O (|N−M|).log10 M*

4.5

4.4.1 j = i+1
4.4.2 left == right
4.4.3 O(n^2) , where n is the number of elements in the array

5) Recommended reading (optional)

Summary:

Graphs represent connections or relations (edges) between real world objects (called nodes or vertices). The vertices adjacent (connected by an edge) to a given vertex are

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its neighbors. A graph is connected if there's at least one path (A sequence of edges) from every vertex to every other vertex. A graph is not to be confused with a binary tree, given that the former one allows for a vertex to have more than two children.

A graph can be directed (edges have a direction indicated by an arrow) or undirected.

The most common data structures to represent graphs are adjacency matrices, two-dimensional arrays in which the elements indicate whether an edge is present between two vertices), and adjacency lists, which can be an array of lists or a list of lists.

If there's a need to traverse through every vertex of the graph, a search of two kinds could be performed: DFS or BFS.

- DFS uses a stack to keep track of where it should go in case of reaching a dead end.

- DFS visits the adjacent vertices of a certain vertex first when possible, if not, it recovers the last vertex of the stack.
- BFS uses a queue.
- BFS visits all the vertices adjacent to one vertex before moving on (like traversing by levels) if there are no more unvisited vertices it removes one from the queue.

A minimum spanning tree (MST) consists of the minimum number of edges necessary to connect all a graph's vertices.

On the other hand, brute force is a straightforward approach to solving a problem, this is one of the easiest algorithms to solve a problem (Just in case that you can use it), the bad news about it is that the time is exponential.

Selection sort: One of the most famous algorithms is Selection Sort, for example, if we want to organize numbers from the smallest to the largest we start by scanning a given list of ints to find the smallest number and if that number is smaller than the one that is in the first place we can exchange them. Then, do the same process with the second one and the rest of them. Thus, selection sort is O(n^2) in all cases.

Closest-pair problem: given a set of n points (which in real life can be airplanes , post offices etc), find a pair of points with the smallest distance between them. To do this we calculate the distance between each pair of distinct points (P1,P2) with the standard Euclidean distance.

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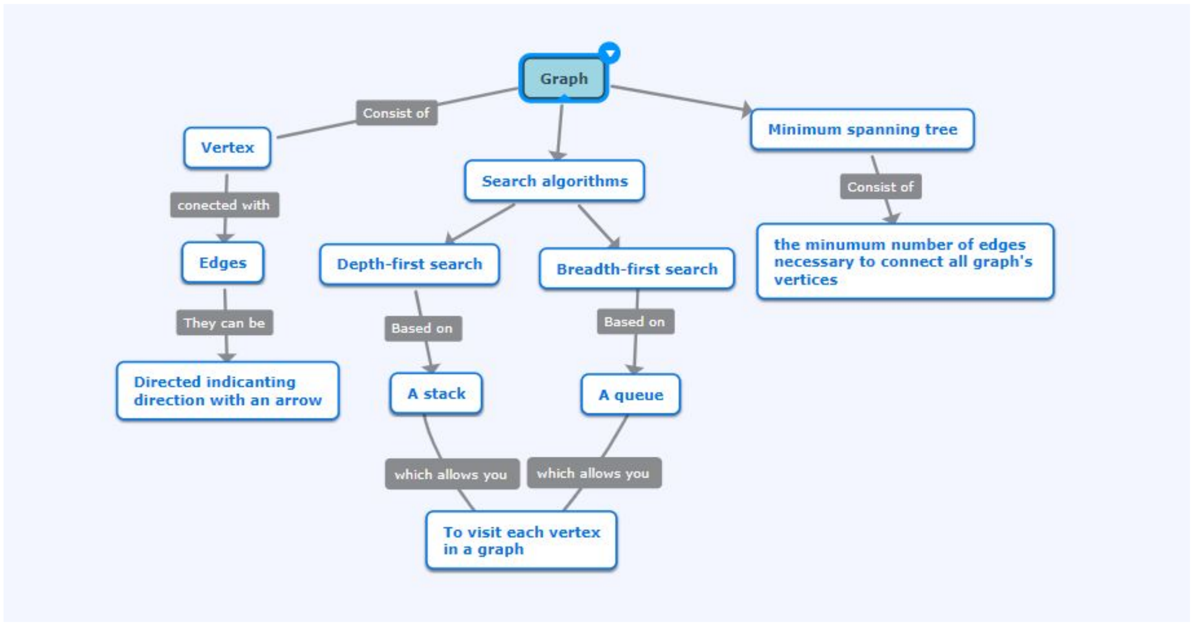
Convex-Hull problem: Given a set of n points we need to construct the convex hull. To solve it we need to find the points that will serve as the vertices of the polygon in question, then we will create a line segment connecting two points and then those two will be part of the convex-hull. Now, if we follow the same path connecting the rest of the vertices and we will get a complete convex-hull.

Exhaustive Search: this approach to combinatorial problems so we generate each element of the problem and select one by one those who satisfy the constraint.

Travelling salesman problem: Is defined as a Hamiltonian circuit so we need to find the cheapest way to visit every node begining and ending in the same node.

Knapsack problem: Given n items of known weights, values and a knapsack with W capacity we need to find the most expensive subset of the items that fit in the knapsack. To solve it we implement exhaustive-search approach generating all the possible answers and choosing the best to solve the problem.

Concept diagram based on the key theoretical elements of "Robert Lafore, Data Structures and Algorithms in Java (2nd edition), Chapter 13: Graphs. 2002"



6) Team work and gradual progress (optional) Discussing

6.1 Meeting minutes

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TEAM MEMBER	DATE	DONE	DOING	TO DO
ISABEL	21/02/2019	Discussing task distribution		Plan data structure for exercise 1,2 in the workshop
SOFIA	21/02/2019	Discussing task distribution		Plan data structure for exercise 1,2 in the workshop
ISABEL	23/02/2019	Data structure works	Solve online exercise	Optional Reading (summary)
SOFIA	23/02/2019	Data structure works	Solve online exercise	Optional Reading(concept map)
ISABEL	24/02/2019	Summary of reading		
SOFIA	24/02/2019	Concept map		
ISABEL	24/02/2019	Answer exercise 3.1-3.3		Code comments
SOFIA	24/02/2019	Answer exercise 3 .4-3.6		Upload code
ISABEL	24/02/2019	Code comments		
SOFIA	24/02/2019	Upload code and report		

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