Laboratory practice No. 5: Graphs

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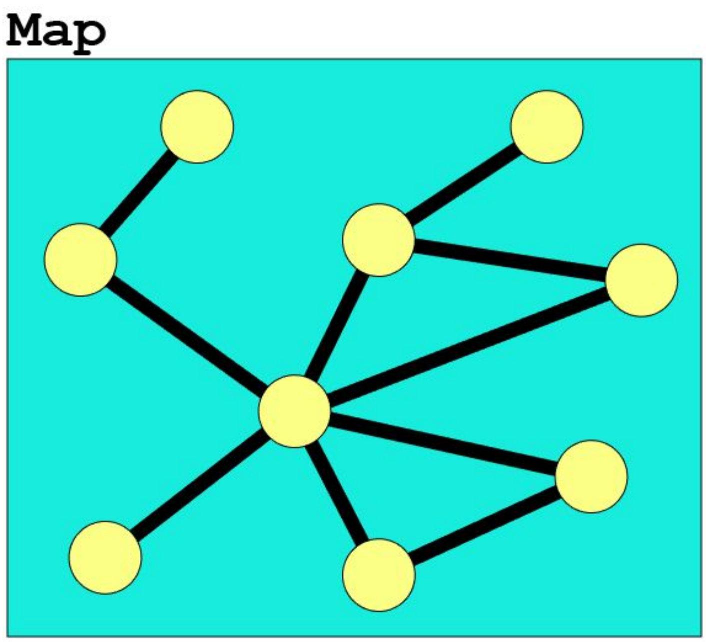
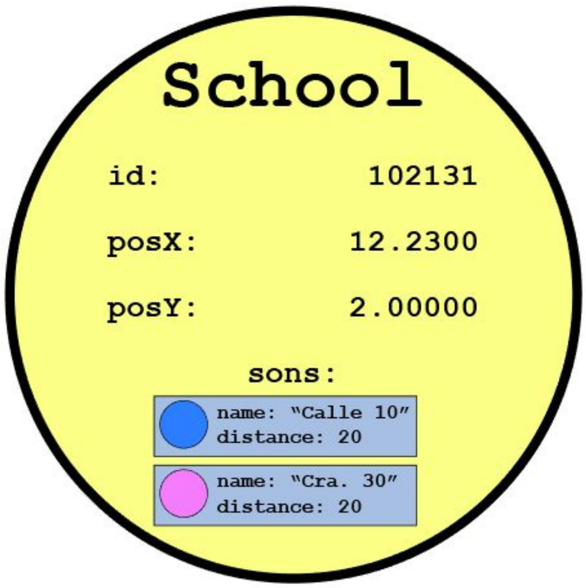
3) Practice for final project defense presentation

3.1 We use a directed graph implementation through an adjacency list.

We named this graph as a Map, any Map has a lot of Nodes and each one of them represents a specific place. Map has a inside LinkedList where nodes are.



Each node has information like name, numeric identifier, x and y coordinates and a LinkedList with its Relations. A Relation refers to street that it connects two nodes. For example, if “School” connects with “Church” through “Evergreen st.”, one Relation of School will be “Evergreen st.”, with its respective distance and ending point (Church).



Map, also, is a directed graph because there are one-directed streets.

3.2 An adjacency matrix is like if we will have a full connected graph with an adjacency list, where each node has a relation with each node. That is, basically, $O(n^2)$ space complexity.

3.3 We use an adjacency list, identifiers are not important. It is a extra information.

3.4 In 2.1, we use an undirected graph implementation through an adjacency matrix. To define if a graph is bicolorable we use a recursive function that it creates a group with sons of “splitter” number and comparates if one of them has another node of the list as a son. If yes, the “splitter” number is changed and repeat until there are no more numbers (int that case, graph

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it is not bicoloreable), if no, graph is bicolorable. this method works with bipartite graph definition (https://en.wikipedia.org/wiki/Bipartite_graph).

3.5 **O(m^{2n})**

3.6 We define complexity as:

$$T(n,\ m) = m + m^2 \cdot T(n-1,\ m)$$

And his base cases:

$T(0,\ m) = false$ (represents default false value)

$T(n, 0)\ =\ true$ (represents default true value)

Where **n** represents possible splitter numbers (equals to m in first call) and **m** represents size of matrix (row and column size are the same value, m)

When we expand this, it is like:

$$T(n,\ m) = \sum_{i=1}^{k} m^{2i-1} + m^{2k} \cdot T(n-k,\ m)$$

Let $k = n$:

$$T(n,\ m) = \sum_{i=1}^{(n)} m^{2i-1} + m^{2(n)} \cdot T(n-(n),\ m)$$

$$T(n,\ m) = \sum_{i=1}^{n} m^{2i-1} + m^{2n} \cdot T(0,\ m)$$

As $T(0,\ m)\ =\ false$, we have this:

$$T(n,\ m) = m + m^3 + m^5 + \ \cdots\ + m^{2n-1} + m^{2n} \cdot false$$

Using sum rule, we define big-O notation as $O(m^{2n} \cdot false)$. And using product rule, this ends as **O(m^{2n})**.

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4) Practice for midterms

4.1

	0	1	2	3	4	5	6	7
0	0	0	0	1	1	0	0	0
1	1	0	1	0	0	1	0	0
2	0	1	0	0	1	0	1	0
3	0	0	0	0	0	0	0	1
4	0	0	1	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	1	0	0	0	0	0
7	0	0	0	0	0	0	0	0

4.2 0 -> [3, 4]

1 -> [0, 2, 5]

2 -> [1, 4, 6]

3 -> [7]

4 -> [2]

5 -> [ ]

6 -> [2]

7 -> [ ]

4.3 **$O(n^2)$**

4.4 Answers:

4.4.1 ii

4.4.2 i

5) Recommended reading (optional)

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6) Teamwork and gradual progress (optional)

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