Algorithmics	Student information	Date	Number of session
	UO: 283928	03/23	Session 4
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Activity 1. Explanation on how the algorithm works.

Given a dictionary of nodes as keys and a list implementation of nodes, where each node represents a country, and the list contains the borders of such nodes. Also, a list of colors must be given, which will be assigned to different nodes, this algorithm places a color per country without repeating colors at borders.

To archive such a task, the algorithm has three loops:

- The outmost one, which iterates over every key in the dictionary.
- The middle one, which does so over every color per key.
- The innermost one, which goes over every border country per color per country.

The point of the algorithm is getting colors just for keys, as borders will eventually get their color value.

To do so, starting from the first key node and the first color, c_0, checks if the current border node has a color assigned:

- If so, gets the following node.
- Otherwise, checks the border nodes' colors if they match c_0:
    - If so, goes to the next color, c_1, and checks again. Repeating until there is a free color.
    - Otherwise, that is, no color at the border is repeated, assigns current color at the border node, and gets the next key node.

Activity 2. Colors required by this implementation.

My implementation only uses two colors, so it can be proven to be wrong by the Four-Color Theorem.

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Activity 3. Variation of number of colors depending on starting node.

I do not think so, as modifying the starting node would arrange the colors in different mappings, but the number of colors required should depend only on the relationships among nodes, that is, the borders.

Activity 4. Maximum number of colors used at most in the best case.

Thanks to the Four-Color Theorem, proven in 1976, it is known the maximum number of colors of any map, where every adjacent border has different color -considering adjacent borders as not just a corner but line in between two countries, to be four.

Activity 5. Algorithm's complexity.

The complexity of this algorithm follows a structure like O(n+m*c), where

- n is the amount of countries
- m is the amount of borders
- c is the total amount of colors used

As per iteration over n, we can have up to m_n * c iterations plus the n itself. Moreover, n is way smaller than m*c and c will be a constant very close to 5 we can omit it.

Thus, the complexity will depend mainly on the amount of borders, that is, O(m).