Stage A - The 4 Color Map Problem

Uncolored Map of Canada - How many colors are needed for this map?

Source: World Stadiums

http://www.worldstadiums.com/north_america/countries/canada/nunavut.shtml

Defining the problem

Richard Mulkman (the client) is the Geography Teacher at the International School of the Rhone and had been working with some 6th Grade students on the countries of Europe. Unfortunately some of his students are not good about bringing in colored pencils and he was forced to share out one student's pencils between the group on his table. So that each student had pencils, one ended up with only three and found she could not complete the exercise without two countries sharing a border having the same color (problem).

After some investigation, Mr Mulkman believed that four colors would be sufficient to color any map regardless of how many countries there were on it. Andy (a 6th Grade student) refused to believe him and insisted that he prove it. After a discussion with Mrs Meyscoli, the Computer Science teacher, I volunteered to develop a solution using Python to confirm Mr Mulkman's statement.

Stating success criteria

Can color any map using no more than 4 colors [this would be better if it was clear that the success was to be able to colour any 'given' map, not taking on a general proof of the four colour theorem]

- Allow the client to easily enter border data for the map and save it in a data file for future use and modification

  - Automatically find a set of colors that color the map correctly
    neighbouring regions (sharing a border) must have different colors
    neighbours sharing only a vertex may have the same color
  - Use fewer than 4 colors if possible
  - Print the solution as a list of regions and corresponding colors

Rationale for the proposed product

I decided to write a dedicated program using a programming language, rather than a web-site, because the solution will require complex logic and fast automation. Users clicking buttons on a web-page won't be much use, as the solution must automatically search for a correct coloring scheme for the map. This should not require user interaction during the search - although the user will need to input the data about which countries are neighbours.

I decided to use Python for the following reasons because:

- I am familiar with Python
- it runs on many platforms
- it has a good development environment
- it is free and requires no licensing

Running on various platforms without a license is attractive because, although Mr. Mulkman is the only user now, other teachers and students might wish to use it in the future, and we cannot be sure that it will always run on a Windows platform.

** Words = 269**

This criterion was awarded 6 marks although the first success criterion was not as clear as it could have been.