Assignment 1, Advanced Functional Programming

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1 Graph Coloring

1.1 Data Structure

The graph data structure consists of a list with tuples where each tuple includes a label which represents a node and list of adjacent labels. The data structure is chosen due to its simplicity to implement.

1.2 Coloring Algorithm

To color the graph we use a brute force backtracking algorithm. We keep track of the colored nodes by using a map. When the size of that map is same as the number of nodes we have colored the whole graph. The backtracking algorithm works by trying out possible solutions, if the solution is not possible i.e the colours run out we step backwards a step to try a new color of the node colored before and try again, etcetera.

1.3 Properties Tested

To start of we test some simple properties that should hold for the data structure. Namely that if we add a node that it should be added to the graph and that edges should behave correctly. We. test that a randomly generated graph that is totally connected, ie all nodes are neighbours should be considered connected.

To test the coloring algorithm we construct a completely connected graph with N nodes and try to color it with N + 1 colors and we should see that succeed.

We also generate random graphs with random connections and check that nodes that are neighbours are not assigned to the same color