**Unit 4 Algorithmics**

**Week 7 Submit Questions**

1. Here, we consider the minimum map colouring problem where we seek to find how to colour a map using as few colours as possible so that no two adjacent nodes share the same colour.

a. How is this different to the 3-colour map problem?

b. Which problem class does the minimum map colouring problem belong to?

c. Describe a deterministic approach to solving the minimum map colouring problem. What is the time complexity of your approach?

d. Explain how we could use simulated annealing to solve this problem. How could this lead to an advantage over the deterministic method you describe above?

2. Consider the A\* algorithm.

a. Explain the algorithm it improves and how it does so.

b. What property of this (or any other) heuristic must be maintained in order to guarantee the optimality of the heuristic?

3. Consider the Travelling Salesman Problem. You are working for a delivery app startup who require you to determine a route that a delivery driver must take in order to quickly deliver their parcels to a given list of different locations. They require you to design an algorithm that finds such a path in reasonable time.

a. Explain why it is not possible for you to guarantee that your solution is the optimal one.

b. Explain how you could use a greedy algorithm to quickly find one solution.

c. Explain how you could use hill-climbing to find a better solution.

d. Explain whether or not your hill-climbing approach will work in reasonable time.