Given a graph G(V,E), we can define $\chi(G)$, the chromatic number of the graph, as the minimum number of colours needed to colour the graph such that no two adjacent nodes are of the same colour. Consider the problem of identifying a colouring of the graph such that the colour(x) = colour (y) if there exists an edge (x,y) in the graph.

Applications?

This problem can be seen as an abstraction of a large number of problems in coordination in the absence of centralised control. Each node only has local knowledge.

Can we achieve a reasonable solution in a non-centralised manner?

Further questions that arise include:
What effect does the topology of the graph play on the success of a de-centralised approach
What effect does the local interactions have?
How quickly can a population recover given a perturbation to the colour of a node?

A simple update mechanism that could be applied: if a node is in a conflict, it changes its colour to get rid of that conflict.

More complex ones could exist. Could explore different notions of neighbourhoods?

Many types of graphs exist that have been studied in detail in similar contexts:

Regular graphs (e.g. rings, 2D lattices)
Random Networks (Erdos-Renyi, Random Geometric Graphs)
Small world graphs (Preferential Attachment)

Step 1
Define/choose a network/graph topology
Randomly assign colours to each node (Note: chose suitable number of colours)
Run experiments to see if correct colouring of the graph can be reached.
Count the number of conflicts over time
Deliverable: description of approach and key parameters; experiments and results; link to code

Step 2:
Identify an avenue to explore.
Define a research question - design an experiment to explore question.
Deliverable: description of the approach and key parameters; experiments and results; link to code; key findings