Problem Formulation

Tutorial 1

Exercise#1

Give a problem formulation for each of the following problems. Choose a formulation that is precise enough to be implemented:

1. Color a planar map

you have to color a planar map using 4 colors, in such a way that no two adjacent regions have the same color.

1. Color a planar map

- **State representation**: list of regions (along with neighborhood info) and assigned colors. Example {R1=Red,R2-Blue…}
- **Initial State**:{No regions colored.}
- **Goal State**: All regions colored, and no two adjacent regions have the same color.
- **Successor function:** Assign a color to a region.
- **Path cost:** Number of assignments.

2. Three jugs

You have three jugs measuring 12 gallons, 8 gallons, and 3 gallons, and a water faucet. You can fill the jugs up or empty them out from one to another or onto the ground. You need to measure out exactly one gallon.

2. Three jugs

- **State representation**: [a,b,c] each represent amount of water in each jug
- **Initial state**: jugs have values [0, 0, 0]
- **Goal test**: jugs have values [a, b, c], where one of a, b, c is 1.
- **Successor function**:
  - given values [a, b, c], generate [12, b, c], [a, 8, c], [a, b, 3] (by filling);
  - [0, b, c], [a, 0, c], [a, b, 0] (by emptying onto the ground);
  - for any two jugs with current values x and y, **pour** y into x; this changes the jug with x to the **minimum** of x+y and the capacity of the jug, and decrements the jug with y by the amount gained by the first jug.
- **Cost function**: Number of actions.

3. Traveling salesman problem

Given a number of cities connected by roads, visit each city exactly once with minimum total traveled distance.

3. Traveling salesman problem

- ***State representation***: the list of cities already visited and the present city.
- ***Initial State***: ({Starting city}, Starting city).
- ***Goal State***: All cities have been visited.
- ***Successor function:*** Move to a city neighboring to the present city, which has not yet been visited.

- ***Path cost:*** Total distance .

4. Missionaries and Cannibals

Three missionaries and three cannibals must cross a river using a boat which can carry at most two people, under the constraint that, for both banks, that the missionaries present on the bank cannot be outnumbered by cannibals. The boat cannot cross the river by itself with no people on board.

Draw the complete state space of the Missionaries and Cannibals Problem.

4. Missionaries and Cannibals

State: a six-tuple of integers listing the number of missionaries, cannibals, and boats on the first side, and then the second side of the river. {M1,C1,B1-M2,C2,B2}

Initial state: all persons and the boat on the original side of the river. {3,3,1-0,0,0}

Successor function: move 1 or 2 people and the boat from one side to another. Actions

that violate the conditions are not allowed.

Goal state: is a state with 3 missionaries and 3 cannibals on the second side.

Path cost: the cost function is one per action.

State space (solution)