Assignment 3 – Part 1: Hill-Climbing Modeling

1. Initial State

Let $S_0 = \{ b, o, o, r, b, r, o, o, r, b, o, r, b \}$
This is a complete initial state using 4 colors (b=blue, o=orange, r=red, j=jungle) in the order:
{BC, AB, SK, MB, ON, QC, NB, NS, PEI, NL, NU, NT, YT}

2. Successor Function

Each successor is generated by changing the color of exactly one region to another color (among the available $k - 1$ alternatives).
For a given state S, the successor states are obtained as:
For each region $i \in [0,12]$, assign a new color $C \neq S[i]$, and generate a new state S' with that modification.

3. Cost Function

Each color has a cost:

- blue = 1
- red = 2
- orange = 3
- jungle = 5

Mathematical formula: $C\ (S) = \sum_0^{12} Cost(S[i])$

4. Heuristic Function $h(S)$

Let A be the 13 x 13 adjacency matrix where $A[i][j] = 1$ if regions i and j are adjacent. Then: $h\ (S) = \sum_{0 \le i < j \le 12} A[i][j] * [1]_{[S[i]=S[j]]}$
Where $[1]_{[S[i]=S[j]]} = 1$ if the same color, 0 otherwise.

5. Goal Test

We reach the goal when no two adjacent regions share the same color.
Formally: $Goal(S) \Leftrightarrow h(S) = 0$