**Task 1: Map Coloring (3-region map)**

**Problem:**

You have 3 countries: A, B, and C.

A borders B and C

B and C do not border each other

You must color the map using 3 colors (Red, Green, Blue), with no two adjacent regions having the same color.

**What to do:**

List variables

Assign domain

Define constraints (binary)

**Solution:-**

Map Coloring Problem (3-region map)

**Variables:**

1. A (Country A)

2. B (Country B)

3. C (Country C)

**Domain:**

Each variable (A, B, C) can take on one of the following values:

- Red (R)

- Green (G)

- Blue (B)

**Constraints (Binary):**

1. A ≠ B (A and B cannot have the same color)

2. A ≠ C (A and C cannot have the same color)

3. B ≠ A (Implicitly covered by A ≠ B)

4. C ≠ A (Implicitly covered by A ≠ C)

5. B ≠ C is not a constraint since B and C do not border each other.

**Task 2: Simple Sudoku (2x2 mini-grid)**

**Problem:**

You are given a 2x2 Sudoku grid with 4 cells: A1, A2, B1, B2.

Each must contain a digit from 1 to 2

No digit repeats in any row or column

**What to do:**

Define the variables

What is the domain of each cell?

Write all constraints (all-diff style)

**Solution:**

Simple Sudoku (2x2 mini-grid)

**Variables:**

1. A1 (Top-left cell)

2. A2 (Top-right cell)

3. B1 (Bottom-left cell)

4. B2 (Bottom-right cell)

**Domain:**

Each variable (A1, A2, B1, B2) can take on one of the following values:

- 1

- 2

**Constraints (All-diff style):**

1. All-diff(A1, A2) - Values in the first row must be different

2. All-diff(B1, B2) - Values in the second row must be different

3. All-diff(A1, B1) - Values in the first column must be different

4. All-diff(A2, B2) - Values in the second column must be different

These constraints ensure that each row and column contains unique digits, following the standard Sudoku rules.

**Task 3: Exam Scheduling**

**Problem:**

You must schedule exams for 3 subjects: Math, English, and Science.

Each exam must be scheduled in one of 2 time slots: Morning, Afternoon

The same teacher teaches Math and Science, so those exams cannot be at the same time

**What to do:**

Variables = subjects

Domains = time slots

Constraint = binary (Math ≠ Science)

**Solution:**

Exam Scheduling Problem

**Variables:**

1. M (Math)

2. E (English)

3. S (Science)

**Domains:**

Each variable (M, E, S) can take on one of the following values:

- Morning (Morn)

- Afternoon (Aft)

**Constraints (Binary):**

1. M ≠ S (Math and Science exams cannot be at the same time)

This constraint ensures that the same teacher is not required to be in two places at once. There are no constraints on the English exam's timing relative to the other subjects.

**Task 4: Cryptarithmetic Puzzle (SEND + MORE = MONEY)**

**Problem:**

In the puzzle SEND + MORE = MONEY, each letter stands for a unique digit from 0–9.

No leading digit (S or M) can be 0.

**What to do:**

Identify all letter variables

State domain for each

**Define constraints:**

Arithmetic equation holds

S ≠ 0, M ≠ 0

**Solution:**

Cryptarithmetic Puzzle (SEND + MORE = MONEY)

**Variables:**

1. S

2. E

3. N

4. D

5. M

6. O

7. R

8. Y

**Domain:**

Each variable can take on a unique digit from 0 to 9.

**Constraints:**

1. AllDiff(S, E, N, D, M, O, R, Y) - Each letter represents a unique digit

2. Arithmetic equation: SEND + MORE = MONEY

- (1000\_S + 100\_E + 10\_N + D) + (1000\_M + 100\_O + 10\_R + E) = (10000\_M + 1000\_O + 100\_N + 10\_E + Y)

3. S ≠ 0, M ≠ 0 - No leading digit can be 0