**Week 5 Lecture Notes**

Constraint Satisfaction Problems: A problem that requires a solution within some limitation or conditions also known as constraints. Consists of:

Finite set of variables which store the solution (V = {V1, V2, …})

Set of discrete values known as domain which the solution is picked (D = {D1, D2, …}))

Finite set of constraints (C = {C1, C2, …})

**CSP Problems:**

Cryptarithmetic (Coding Alphabets to Numbers)

n-Queen (In an n-Queen problem, n queens should be placed in an nXn matrix such that no queen shares the same row, column or diagonal).

Map Colouring (Political map – colouring different regions of map, ensuring no adjacent regions have the same colour)

Crossword (Puzzles)

Sudoku (puzzle)

Latin Square Problem

**EXAMPLE**: Map Colouring

**Variables**: (WA, NT, Q, NSW, V, SA, T) American states

**Domains**: D = {red, green, blue} Colours

**Constraints**: Adjacent regions must have different colours.

**Implicit**: WA != NT

**Explicit**: (WA, NT) {(red, green), (red, blue)} they can be different combination of colours but cannot be the same such as (red, red)

**Solution**: {WA: red , NT: blue ,…}

Types of Constraints:

**Unary Constraint**: Involves a single variable (X! = 4)

**Binary Constraint**: Involves pairs of variables (X! = Y)

**Higher-order constraints**: Involves 3 or more variables when there are restrictions on more than two variables

**Backtracking Search**: Basic uninformed algorithm for solving CSPs.

Start with no assignment,

Pick a variable and assign it. Repeat

If we hit a dead end backtrack up the tree until we find a variable that can have its value set to something different.

Backing all the way up the tree to the root, and finding no more values means no SOLN.

DFS that Chooses one variable at a time.

**Filtering: Forward Checking**

Forward Checking is an extension of backtracking search that employs a modest amount of propagation (lookahead).

Filtering: Keeps track of domains for unassigned variables and cross off bad options

Forward Checking: Cross off values that violate a constraint when added to existing assignment.