**CSE 537: Project 03: Golomb Ruler**

**Project Report**

Submitted by

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**Introduction:**

Constraint Satisfaction problems are class of problems where the path to the goal is not important but finding the goal is important. This is achieved when each variable is assigned a value which does not vioalte any constraint on the variable. Heuristics that can be used to assign values to the variables are Backtraking, Forward Checking, Constraint Propagation.

**Golumb Ruler:**

Selecting M number of marks for a Golumb ruler of the length L is a CSP problem where the constraint is that the marks of distinct length has to be selected for length L.

**Backtracking:**

Backtracking is assigning a value to variable one after the other such that the assignment does not violate any constraints. If any variable runs out of any legal values in its domain, we backtrack previous assignments and assign different value to the violating variable.

Approach :

1. Given the order M and length L of Golumg ruler.
2. For each position of marks in Golumb ruler from 0 to L+1 is marked with -1.
3. First mark 0 is added to the markslist.
4. Check the next mark with each entry in the markslist. If they represent distinct length without violating the constraint with any of the previous assignments and if the total marks count does not exceed the given M.
5. If no constraint is violated, move to the next mark in the markslist and repeat the same checks in step 4.
6. If a newly taken mark is violating any previous assignments, then backtrack to the violating assignment and remove it from the list of taken marks and assign the flag back to -1.
7. Repeat the steps 4-6 until the list of taken marks counts to M and the total length of M is covered with the taken marks.

Ouput :

For M = 4 and L=6,

The variable assignment order using Backtracking is [0] - [0, 1] - [0, 1, 3] - [0, 1, 4] - [0, 1, 4, 6]

Final assignment is [0, 1, 4, 6])

**Forward Checking:**

Forward Checking identifies the failure one step before backtracking. In forward checking, the impact of each assignment is checked with its immediate neighbors and the assigned value is removed from the domain of its immediate neighbors to prevent violation of the constriant.

For M = 4 and L=6,

The variable assignment order using Forward Checking is

Final assignment is

**Constarint Propagation :**

Constraint Propagation is based on the idea that reducing the number of legal values for a variable can in turn reduce the legal values for another variable, and so on.

For M = 4 and L=6,

The variable assignment order using Constarint propagation is

Final assignment is

**Conclusion :**