# Project 03: THE GOLOMB RULER

COURSE: ARTIFICIAL INTELLIGENCE (CSE 537)

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## 1. Introduction

A Golomb ruler is a set of marks at integer positions along an imaginary ruler such that no two pairs of marks are the same distance apart. The number of marks on the ruler is its *order*, and the largest distance between two of its marks is its *length*. A Golomb ruler is *optimal* if no shorter Golomb ruler of the same order exists.For example, the set (0, 1, 3, 7) is 4-mark Golomb ruler since its differences are (1=1-0,2=3-1,3=3-0,4=7-3,6=7-1,7=7-0) all of which are distinct.

Below are some examples of optimal Golomb rulers:

| Order | Length | Marks |
|---|---|---|
| 2 | 1 | 0 1 *(perfect)* |
| 3 | 3 | 0 1 3 *(perfect)* |
| 4 | 6 | 0 1 4 6 *(perfect)* |
| 5 | 11 | 0 1 4 9 11<br>0 2 7 8 11 |

## 2. Question1 - Plain Backtracking

Backtracking is the basic uninformed search algorithm for solving CSPs. The basic idea of algorithm is to consider one variable at a time, check the constraints and consider the values that do not conflict the previous assignments.

For Golomb rulers implementation, a recursive backtracking function is implemented. The domain values are checked for the completeness and consistency. The assignment is consistent if no two pairs of marks are same distance apart. Once all the domain values are checked and no values are left, the assignment is complete.

Number of consistency checks in Backtracking for length 6 and order 4 is 4 and the output is shown as below:

**1.2 Output:**

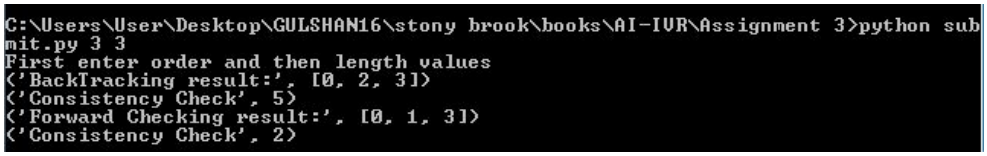
```
C:\Users\User\Desktop\GULSHAN16\stony brook\books\AI-IVR\Assignment 3>python sub
mit.py 4 6
First enter order and then length values
('BackTracking result:', [0, 1, 4, 6])
('Consistency Check', 4)
('Forward Checking result:', [0, 1, 4, 6])
('Consistency Check', 5)
```

## 2. Question2 -BT + Forward Checking (FC)

Forward checking keeps track of remaining values for unassigned variables. A value is removed from the variables if it is not consistent with the assignment. It backtracks if no legal values are left in the assignment.The forward check is terminated once all the assignments are completed.

Number of consistency checks in Forward Checking for length 6 and order 4 is 4 and the output is shown as below:

**2.2 Output:**




# 3. REFERENCE:


1. *Artificial Intelligence: A Modern Approach, 3e, Stuart Russell and Peter Norvig*
2. *https://en.wikipedia.org/wiki/Golomb_ruler#Golomb_rulers_as_sets*