Lab 2 - CSPs – Artificial Intelligence

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Tasks

1. Modeling the problem as CSP

Below are the variables and their domains in the format *Name : {value$_1$ ... value$_N$}*.

Colors: {Red, Green, Ivory, Yellow, Blue}

Nationalities: {English, Spanish, Norwegian, Ukrainian, Japanese}

Cigarettes: {Old Gold, Kools, Chesterfields, Lucky Strike, Parliaments}

Pets: {Dog, Zebra, Horse, Snail, Fox}

House: {First, Second, Third, Fourth, Fifth}

Drink: {Orange Juice, Water, Tea, Coffee, Milk}

Constraints

$Nationality_{English} = Color_{Red}$
$Nationality_{Spanish} = Pet_{Dog}$
$Drink_{Coffee} = Color_{Green}$
$Nationality_{Ukrainian} = Drink_{Tea}$
$Color_{Green} = Color_{Ivory}+1$
$Cigarettes_{OldGold} = Pet_{Snails}$
$Cigarettes_{Kools} = Color_{Yellow}$
$Drink_{Milk} = 3$
$Nationality_{Norwegian} = 1$
$Cigarettes_{Cherterfields} = |Pet_{Fox} - Cigarettes_{Cherterfields}|$
$Cigarettes_{Kools} = |Pet_{Horse}$ - $Cigarettes_{Kools}|$
$Cigarettes_{LuckyStrike} = Drink_{OrangeJuice}$
$Nationality_{Japanese} = Cigarettes_{Parliments}$
$Color_{Blue} = Nationality_{Norwegian} + 1$

The Norwegian drinks the water and the Japanese owns the Zebra.

2. Size of the state space

The state space is the number of domains d to the number of variables n or d^n.

4. Results

By looking at the running time and visited states we can safely assume that looking at the most constrained variable and least constraining value is the least optimized strategy aside from choosing a algorithm. Looking at the most constrained variable and least constraining value limits future possibility for their values and drastically increases the amount of states the algorithm chooses to visit and in turn increases the running time.

AC3 is a lot more optimized than forward checking. AC3 can detect inconsistent constraints before traveling far down that branch of the search tree.

	Running Time	Visited states
backtracking + AC3 + most constrained variable + least constraining value	0.047s	26
backtracking + AC3 + most constrained variable	0.02s	41
backtracking + AC3	0.005s	27
backtracking + forward checking + most constrained variable + least constraining value	117.491s	20632374
backtracking + forward checking + most constrained variable	51.957s	17321613
backtracking + forward checking	0.01s	3893