

CS221 Assignment: Scheduling

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Problem 0

- (a) If we consider a CSP with m variables and n constraints we would have variables that correspond to the light switches: $X_1, X_2, \dots, X_m \in \{0, 1\}$ such that $X_i = 1$ if the button i is pressed and zero if it is unpressed.

The constraints: t_1, t_2, \dots, t_m such that $t_i = \text{mod}_2(\sum_{j=0}^n ([i \in T_j] X_j))$.

- (b) (I) There are two consistent assignments: 1,0,1 and 0,1,0.

(II) We get 9 calls to backtrack() The stack frame will look as follows:

```
[x={}, w=1, {{0,1},{0,1},{0,1}}]
[x={X1:0}, w=1, {{0,1},{0,1},{0,1}}]
[x={X1:0, X3:0}, w=1, {{0,1},{0,1},{0,1}}]
[x={X1:0, X3:0, X2:1}, w=1, {{0,1},{0,1},{0,1}}] --> ret (0,1,0)
[x={X1:0, X3:1}, w=1, {{0,1},{0,1},{0,1}}]
[x={X1:1}, w=1, {{0,1},{0,1},{0,1}}]
[x={X1:1, X3:0}, w=1, {{0,1},{0,1},{0,1}}]
[x={X1:1, X3:1}, w=1, {{0,1},{0,1},{0,1}}]
[x={X1:1, X3:1, X2:0}, w=1, {{0,1},{0,1},{0,1}}] --> ret (1,0,1)
```

(III) With AC-3 we get 7 calls to backtrack:

```
[x={}, w=1, {{0,1},{0,1},{0,1}}]
[x={X1:0}, w=1, {{0,1},{1},{0}}]
[x={X1:0, X3:0}, w=1, {{0,1},{1},{0}}]
[x={X1:0, X3:0, X2:1}, w=1, {{0,1},{1},{0}}] --> ret (0,1,0)
[x={X1:1}, w=1, {{0,1},{0},{1}}]
[x={X1:1, X3:1}, w=1, {{0,1},{0},{1}}]
[x={X1:1, X3:1, X2:0}, w=1, {{0,1},{0},{1}}] --> ret (1,0,1)
```

Problem 2

- (a) We will introduce an auxiliary variable A as a tuple with two entries. We will then enforce three binary constraints $[A[0] = X_1]$, $[A[1] = A[0] + X_2]$ and $[A[1] + X_3 \leq K]$ thus we will have $A[1] = X_1 + X_2$ and we will be enforcing that $(X_1 + X_2) + X_3 \leq K$

Problem 2

- (a)
- (b)
- (c) This is the content of the file I submitted as a schedule:

```
minUnits 4
maxUnits 16
```

```
register Aut2019
register Win2020
register Spr2020
```

```
taken CS107
taken CS103
taken CS109
taken CS161
taken CS221
taken CS229A
taken MATH52
taken CS106B
taken PHYSICS43
taken PHYSICS41
taken MATH51
```

```
request CS110 weight 2
request CS181 weight 2
request CS154 weight 2
request MATH104 weight 2
request ECON1 weight 1.5
request MATH53 weight 1.5
```

This is what I got as an optimal schedule

Quarter Units Course

Aut2019 5 MATH53

Win2020 4 CS154

Spr2020 4 CS110

Spr2020 4 CS181

Spr2020 3 MATH104

Spr2020 5 ECON1

Of course in real life that is not a great schedule because it does not balance the workload between the quarters but it fits everything according to the constraints.