

1. Crossword Puzzles pt. 1

1. The variables are all the horizontal and vertical word spaces, which can take on any value from the provided dictionary. The constraints are that every space is filled, the word chosen for a specific position must have that position's length, and that anywhere two words intersect they share the same letter.
2. The variables here are each individual spaces in the grid, which can take on any value from A to Z. The constraints are that any vertically or horizontally contiguous blocks must form a word from the given dictionary.
3. To implement this constraint in the first case we can check if any two variables are words which are too similar. In the second case we can treat contiguous blocks as words and evaluate them the same way.

2. Arc Consistency

1. Analysis (A): 2  
Analysis II (B): 3  
Linear Algebra (C): 1  
Number Theory (D): 2  
Modern Algebra (E): 1

2. Domain: {1, 2, 3}

# of  $1 \leq 2$

# of  $2 \leq 2$

# of  $3 \leq 2$

$A < B$

$C < D$

$E < D$

$A \neq C$

3. Running AC-3

(a) Remaining domains after enforcing arc consistency on initial CSP

A	B	C	D	E
1, 2	2, 3	1, 2	2, 3	1, 2

(b) Remaining domains after enforcing arc consistency after assigning  $A = 1$

A	B	C	D	E
1	2, 3	2	3	1, 2

#### 4. One Semester AC-3

A	B	C	D	E
1	1	1	1	1

Because Alice wants to finish in one semester, the domain consists of only 1. Therefore, AC-3 will fail on the first arc it tests,  $A \rightarrow B$ ; 1 is not less than 1. AC-3 then fails initially, before any values are assigned.