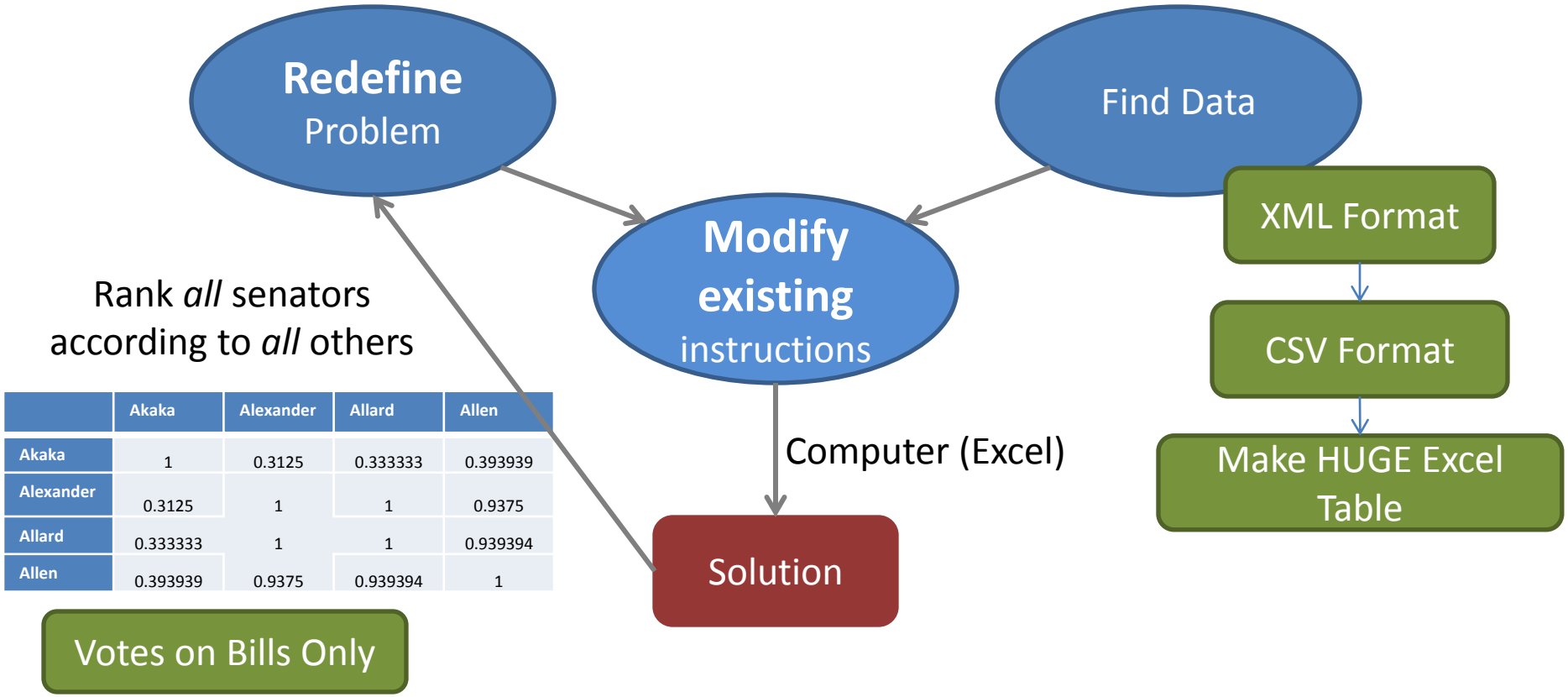
# Discovering Voting Patterns

Feb. 16, 2012

# This Class




Rank *all* senators according to *all* others

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| Akaka | 1 | 0.3125 | 0.333333 | 0.393939 |
| Alexander | 0.3125 | 1 | 1 | 0.9375 |
| Allard | 0.333333 | 1 | 1 | 0.939394 |
| Allen | 0.393939 | 0.9375 | 0.939394 | 1 |

# Last Task

What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | Yea | Yea | Nay | Not Voting |
| **Alexander** | Nay | Yea | Nay | Nay |
| **Allard** | Yea | Not Voting | Yea | Yea |
| **Allen** | Nay | Nay | Nay | Nay |

What We Want:

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 1 | 0.3125 | 0.333333 | 0.393939 |
| **Alexander** | 0.3125 | 1 | 1 | 0.9375 |
| **Allard** | 0.333333 | 1 | | |
| **Allen** | 0.393939 | 0.9375 | | |

$$\frac{\text{num\_agree} - \text{num\_disagree}}{\text{num\_agree} + \text{num\_disagree}}.$$

# Last Task

## What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | Yea | Yea | Nay | Not Voting |
| **Alexander** | Nay | Yea | Nay | Nay |
| **Allard** | Yea | Not Voting | Yea | Yea |
| **Allen** | Nay | Nay | Nay | Nay |

## What We Want:

num_agree – num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 10 | 11 | 13 |
| **Alexander** | 10 | 32 | 32 | 30 |
| **Allard** | 11 | 32 | 33 | 31 |
| **Allen** | 13 | 30 | 31 | 33 |

num_agree + num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 32 | 33 | 33 |
| **Alexander** | 32 | 32 | 32 | 32 |
| **Allard** | 33 | 32 | 33 | 33 |
| **Allen** | 33 | 32 | 33 | 33 |

# Last Task

1 for a Yea
-1 for a Nay
0 for Not Voting

## What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | Yea | Yea | Nay | Not Voting |
| **Alexander** | Nay | Yea | Nay | Nay |
| **Allard** | Yea | Not Voting | Yea | Yea |
| **Allen** | Nay | Nay | Nay | Nay |

## What We Want:

num_agree – num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 10 | 11 | 13 |
| **Alexander** | 10 | 32 | 32 | 30 |
| **Allard** | 11 | 32 | 33 | 31 |
| **Allen** | 13 | 30 | 31 | 33 |

num_agree + num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 32 | 33 | 33 |
| **Alexander** | 32 | 32 | 32 | 32 |
| **Allard** | 33 | 32 | 33 | 33 |
| **Allen** | 33 | 32 | 33 | 33 |

# Last Task

1 for a Yea
-1 for a Nay
0 for Not Voting

## What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | 1 | 1 | -1 | 0 |
| **Alexander** | -1 | 1 | -1 | -1 |
| **Allard** | 1 | 0 | 1 | 1 |
| **Allen** | -1 | -1 | -1 | -1 |

## What We Want:

num_agree – num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 10 | 11 | 13 |
| **Alexander** | 10 | 32 | 32 | 30 |
| **Allard** | 11 | 32 | 33 | 31 |
| **Allen** | 13 | 30 | 31 | 33 |

num_agree + num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 32 | 33 | 33 |
| **Alexander** | 32 | 32 | 32 | 32 |
| **Allard** | 33 | 32 | 33 | 33 |
| **Allen** | 33 | 32 | 33 | 33 |

# How Can Matrix Multiplication Help?

What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | 1 | 1 | -1 | 0 |
| **Alexander** | -1 | 1 | -1 | -1 |
| **Allard** | 1 | 0 | 1 | 1 |
| **Allen** | -1 | -1 | -1 | -1 |

What We Want:

num_agree – num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 3 | 1 | 0 | -1 |
| **Alexander** | 1 | 4 | -3 | 2 |
| **Allard** | 0 | -3 | 3 | -3 |
| **Allen** | -1 | 2 | -3 | 4 |

num_agree + num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 3 | 3 | 2 | 3 |
| **Alexander** | 3 | 4 | 3 | 4 |
| **Allard** | 2 | 3 | 3 | 3 |
| **Allen** | 3 | 4 | 3 | 4 |

# How Can Matrix Multiplication Help?

## What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | 1 | 1 | -1 | 0 |
| **Alexander** | -1 | 1 | -1 | -1 |
| **Allard** | 1 | 0 | 1 | 1 |
| **Allen** | -1 | -1 | -1 | -1 |

## What We Want:

num_agree – num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 10 | 11 | 13 |
| **Alexander** | 10 | 32 | 32 | 30 |
| **Allard** | 11 | 32 | 33 | 31 |
| **Allen** | 13 | 30 | 31 | 33 |

num_agree + num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 32 | 33 | 33 |
| **Alexander** | 32 | 32 | 32 | 32 |
| **Allard** | 33 | 32 | 33 | 33 |
| **Allen** | 33 | 32 | 33 | 33 |

# How Can Matrix Multiplication Help?

What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | 1 | 1 | -1 | 0 |
| **Alexander** | -1 | 1 | -1 | -1 |
| **Allard** | 1 | 0 | 1 | 1 |
| **Allen** | -1 | -1 | -1 | -1 |

What We Want:

num_agree – num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 10 | 11 | 13 |
| **Alexander** | 10 | 32 | 32 | 30 |
| **Allard** | 11 | 32 | 33 | 31 |
| **Allen** | 13 | 30 | 31 | 33 |

MMULT(Table, TRANSPOSE(Table))

num_agree + num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 32 | 33 | 33 |
| **Alexander** | 32 | 32 | 32 | 32 |
| **Allard** | 33 | 32 | 33 | 33 |
| **Allen** | 33 | 32 | 33 | 33 |

?

# How Can Matrix Multiplication Help?

What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | 1 | 1 | +1 | 0 |
| **Alexander** | +1 | 1 | +1 | +1 |
| **Allard** | 1 | 0 | 1 | 1 |
| **Allen** | +1 | +1 | +1 | +1 |

What We Want:

num_agree – num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 10 | 11 | 13 |
| **Alexander** | 10 | 32 | 32 | 30 |
| **Allard** | 11 | 32 | 33 | 31 |
| **Allen** | 13 | 30 | 31 | 33 |

MMULT(Table, TRANSPOSE(Table))

num_agree + num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 32 | 33 | 33 |
| **Alexander** | 32 | 32 | 32 | 32 |
| **Allard** | 33 | 32 | 33 | 33 |
| **Allen** | 33 | 32 | 33 | 33 |

?

# How Can Matrix Multiplication Help?

What We Have:

| | 1:1 | 1:2 | 1:3 | 1:4 |
|---|---|---|---|---|
| **Akaka** | 1 | 1 | -1 | 0 |
| **Alexander** | -1 | 1 | -1 | -1 |
| **Allard** | 1 | 0 | 1 | 1 |
| **Allen** | -1 | -1 | -1 | -1 |

What We Want:

num_agree – num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 10 | 11 | 13 |
| **Alexander** | 10 | 32 | 32 | 30 |
| **Allard** | 11 | 32 | 33 | 31 |
| **Allen** | 13 | 30 | 31 | 33 |

MMULT(Table, TRANSPOSE(Table))

num_agree + num_disagree

| | Akaka | Alexander | Allard | Allen |
|---|---|---|---|---|
| **Akaka** | 33 | 32 | 33 | 33 |
| **Alexander** | 32 | 32 | 32 | 32 |
| **Allard** | 33 | 32 | 33 | 33 |
| **Allen** | 33 | 32 | 33 | 33 |

MMULT(ABS(Table),TRANSPOSE(ABS(Table))

# Steps in the Analysis

1. Create a formula:

1 for a Yea (or a 2)
-1 for a Nay (or a 1)
0 for Not Voting (or a 0)

2. Use MMULT() to create a `Numerator` table
3. Use MMULT() to create a `Denominator` table
4. Make the final table

$$\frac{\text{num\_agree} - \text{num\_disagree}}{\text{num\_agree} + \text{num\_disagree}}.$$

# Reminders

| Sun | Mon | Tues | Wed | Thurs | Fri | Sat |
|---|---|---|---|---|---|---|
| 2/12 | 2/13 | 2/14 | 2/15 | 2/16 | 2/17 | 2/18 |
| | | | | Finish Voting<br>Proposal Due | | |
| 2/19 | 2/20 | 2/21 | 2/22 | 2/23 | 2/24 | 2/25 |
| | | No Class<br>Comments & Code Back | | Start Textual Analysis<br>HW2-1 Out | | |
| 2/26 | 2/27 | 2/28 | 2/29 | 3/1 | 3/2 | 3/3 |
| | | Project 1 Due<br>HW2-1 Due | | | | |