Ranking Senators with Senator X’s Votes

Feb 6, 2014
Questions about HW?
Use Bernie Sanders' votes to compare how liberal other senators are.

Vote on bills only!
ACT1-2, Task 2: Rank Each Senator by Bernie Sanders-ness
What We’ve Accomplished

Use Bernie Sanders’ votes to compare how liberal other senators are

Vote on bills only!
New Problem

Redefine Problem

Use Senator X’s votes to compare how liberal other senators are

Modify existing instructions

Find Data

XML Format

CSV Format

Computer (spreadsheet)

Make a HUGE Spreadsheet table

Solution

Vote on bills only!
In Activity 1-3, you’ll...

• Learn new spreadsheet techniques
• Rank relative to any senator, not just Bernie
• Task 2 will make a nice spreadsheet that can be used by others

• Start by doing Task 1 with a partner...
Reminder about OFFSET

OFFSET: Returns a reference to a range that is a specified number of rows and columns from a cell or range of cells. The reference that is returned can be a single cell or a range of cells.

OFFSET(reference, rows, cols, [height],[width])

• Go ahead and start on Part 1.
BREAK
After task 1

• Any questions?
• Move on to Task 2: making a spreadsheet that shows comparison results vs ANY senator, not just Sanders.
Activity 1-3

• Task 2
  – We broke this task down into manageable pieces.
  – Nice formatting is useful
  – This spreadsheet is now useful for other people
  – It’s a generalization of the Sanders spreadsheet, and took almost no time to create!
    • If you’d done the Sanders work by hand, redoing it for a new senator would have taken just as long
BREAK
Rankings

• Who is least like Bernie?
• What are the rankings relative to that person?
• How do they compare to the Bernie rankings?
  – Rank Bernie on your screen; get a friend to reverse-rank vs Bernie’s nemesis. Compare.
Discussion

• Is ranking relative to Sanders (or Coburn) really a measurement of liberalness? If so, why don’t they give exact opposite results?
• What if we had used Akaka, or some other very liberal senator, instead of Sanders? Same results? Shuffled?
• Let’s look at all possible orderings!
Activity 1-4

• To compare everyone with Sanders
  – We filled a tab with vote-by-vote comparisons
• To compare everyone with each other senator
  – Make 100 tabs???
Activity 1-4 (preview of next class)

• We’re saved from making 100 tabs by good luck
  — ...or perhaps by clever choices before class started
• Re-code: Yes $\rightarrow$ +1; No $\rightarrow$ -1.
• Now can compare using multiplication!

\[
\begin{array}{ccccccc}
0 & 1 & 1 & -1 & 1 & 0 & -1 \\
1 & 0 & 1 & -1 & -1 & 1 & 0 \\
\end{array}
\]

--------------------------------------------

\[
\begin{array}{ccccccc}
0 & 0 & 1 & 1 & -1 & 0 & 0 \\
\end{array}
\]

0: 2 agree, 1 dis.
What to do with an agree-and-disagree list

• Sum up entries to get
  \[\text{agree} - \text{disagree}\]

• Sum up absolute values to get
  \[\text{agree} + \text{disagree}\]

• Compute the ratio
Need to do this for every pair of senators

• One strategy:
  – For each pair of senators
    • Form an agree/disagree list
    • Sum it
    • Sum its absolute values
    • Take the quotient
For each pair of senators

- Compute the sum of the products of the senators’ votes
- And the sum of the products of the absolute values of the senators’ votes
- ...and find the quotient
<table>
<thead>
<tr>
<th></th>
<th>Sen 1</th>
<th>Sen 2</th>
<th>Sen 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sen 1</td>
<td>1</td>
<td>0.22</td>
<td>-0.3</td>
</tr>
<tr>
<td>Sen 2</td>
<td>0.22</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Sen 3</td>
<td>-0.3</td>
<td>0.5</td>
<td>1</td>
</tr>
</tbody>
</table>
Making labels

• Row labels are easy: copy from the re-coded vote tab

• Column labels????
  – Want to use the row labels
  – But we want to “fill” across instead of down
Column Labels

• Solution 1:
  – In cell A1 of your table, put 
    \(=\text{transpose}(	ext{votes}!A1:A105)\)
  – Takes a block of cells and “flips it” over the NW-SE axis:

• Why is that built in?
  – Part of “matrix operations” that come up a lot
More complex (and richer) answer

- Column() tells you what column this cell is in, so if you put =COLUMN() in cell C7, the value is 3
- What’s the value if you put it in cell B1?
- ROW() does similar things for rows...
What do these produce?

• Assume each of these is in cell C1
  – =OFFSET(votes!A1, 0, 0)
  – =OFFSET(votes!A1, 2, 0)
    Hint: Akaka, Alexander, Ayotte, Barrasso, ...
  – =OFFSET(votes!A1, 3, 0)
  – =COLUMN()
  – =OFFSET(votes!A1, COLUMN(), 0)
  – =OFFSET(votes!A1, COLUMN()-1, 0)
Filling

• If we have
  \[ =\text{OFFSET}(\text{votes!A1, COLUMN()}-1, 0) \]
in cell C1, what will be in D1 if we fill right?
  \[ =\text{OFFSET}(\text{votes!B1, COLUMN()}-1, 0) \]

• Result will be? Hint: not a senator name

• Better:
  \[ =\text{OFFSET}(\text{votes!$A$1, COLUMN()}-1, 0) \]

• If we fill \textit{this} across row, we’ll get all senator names!
General Technique

• Use OFFSET, combined with ROW or COLUMN, to turn a vertical sequence of references into a horizontal one, and vice versa
Another useful built-in function: **SUMPRODUCT**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The formula \( =\text{SUMPRODUCT}(A1:C1, A2:C2) \) gives 18:

\[ (11 \times 0) + (7 \times 2) + (4 \times 1) \]

- Two ranges have to have same length...and both horizontal or both vertical
- SUMPRODUCT multiplies corresponding elements; sums up results
- Handy when one row contains prices, another contains quantities
  - SUMPRODUCT produces the total cost of buying things!
- You can use TRANSPOSE to get around the “both horizontal” restriction: see HW.
Back to voting

- We’ve got this:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Akaka</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>...</td>
</tr>
<tr>
<td>2</td>
<td>Alexander</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>...</td>
</tr>
</tbody>
</table>

- Formula to compute *agree-disagree* for Akaka and Alexander?

  \[=\text{SUMPRODUCT} (B1:AQ1, B2:AQ2)\]

- Formula to compute *agree + disagree*?

  \[=\text{SUMPRODUCT} (\text{ABS}(B1:AQ1), \text{ABS}(B2:AQ2))\]
Formula for *agree - disagree*

- For Akaka and Alexander:
  \[ = \text{SUMPRODUCT} (B1:AQ1, B2:AQ2) \]
- For 12\(^{th}\) and 19\(^{th}\) senator?
  \[ = \text{SUMPRODUCT} (B12:AQ12, B19:AQ19) \]
- For \(i\)th and \(j\)th senator?
  - ???
  - Data for \(i\)th senator is in
    \[ \text{OFFSET} (B1:AQ1, i-1, 0) \]
- **Solution:**
  \[ = \text{SUMPRODUCT} (\text{OFFSET} (B1:AQ1, i-1, 0), \text{OFFSET} (B1:AQ1, j-1, 0)) \]
Goal: Build a table containing all pairs of senator *agree-disagree* values

- \(i\)th senator is in row \(i + 1\), because of header row
- \(j\)th senator is in column \(j + 1\), because of row-labels
- Formula:
  
  \[
  =\text{SUMPRODUCT} (\text{OFFSET} ($B$1:$AQ$1, \text{ROW()} - 2, 0),
  \text{OFFSET} ($B$1:$AQ$1, \text{COLUMN()} - 2, 0))
  \]
Warning about this task

• Building that “similarity” table is a lot of computation
• May be quite slow
• We’re pushing the limits here...
Next time

• Build that similarity table
• How can we make sense of the 10,000 items in it?