Math 181: Exam 2 review

1. Consider the following set of ballots.

A A C C B  
B B A A C  
C C A A C

(a) Who wins using the plurality runoff (two-round plurality) rule?

(b) How can the voter in the first column change her vote so that she is happier with the outcome?

2. For this problem, we consider a rule called Coombs's Rule. The method operates like the Hare system, but instead of deleting the candidates with the fewest first-place votes, it deletes candidates with the most last place votes. Consider the following set of ballots:

A B C C D  
B A B B B  
C C A A C  
D D D D A

(a) Which candidate wins using Coomb's rule?

(b) Which candidate wins using the Hare system?
3. Consider the following preference ballots and find a winner using the following voting systems

\[ \begin{array}{cccc}
A & B & C & D \\
B & A & B & B \\
C & C & A & A & C \\
D & D & D & D & A \\
\end{array} \]

(a) plurality
(b) Hare system
(c) plurality runoff
(d) Condorcet’s method
(e) Borda count
(f) sequential pairwise voting with agenda \( A, C, B, D \).

4. What is the difference between monotonicity and IIA?

5. Explain why sequential pairwise voting satisfies the CWC.
6. Consider the following election

<table>
<thead>
<tr>
<th># of voters</th>
<th>2</th>
<th>2</th>
<th>1</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>E</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>B</td>
<td>A</td>
<td>E</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>D</td>
<td>A</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>C</td>
<td>E</td>
<td>C</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

(a) plurality       (d) Condorcet’s method

(b) Hare system     (e) Borda count

(c) plurality runoff (f) sequential pairwise voting with agenda $A, B, C, D, E$. 
7. Use the Luhn algorithm to find the second digit in the credit card number 792739871034653

8. Fiberglass insulation comes in 36-in precut sections. A plumber must install insulation in a basement on piping that is interrupted often by joints. The distances between the joints on the stretches of pipe that must be insulated are 12, 15, 16, 12, 9, 11, 15, 17, 12, 14, 17, 18, 19, 21, 31, 7, 21, 9, 23, 24, 15, 16, 12, 9, 8, 27, 22, 18 inches. How many precut sections would he have to use to provide the insulation if he bases his decision on

(a) next-fit?

(b) next-fit decreasing?

(c) worst fit?

(d) worst-fit decreasing?