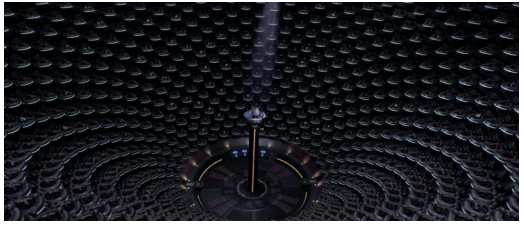
Voting Theory – basics

- Why voting theory?

Voting Theory – basics

- Why voting theory? Democracy



is better than

Voting Theory – basics

- Why voting theory? Democracy
  - Democracy is rule by the people.
  - “The people” don’t always agree.
  - We take a vote to make decisions.
  - We want the results of the vote to reflect the true will of the people.

Voting Theory – basics

- Voting theory is more complicated than you might think.

Voting Theory – basics

- By the way, all the examples will be “vote for the following candidates”. As in, people are getting voted for some office.
- All the theory works fine for voting on proposals such as. . .

Voting Theory – basics

- What should we do after dinner?
  - A. Go and protest people that tell you to “have a good day”.
  - B. Make a meme for the internets.
  - C. Have a same-sex wedding for an assault rifle and a shotgun.
  - D. Eat more dinner.

:-)

Voting Theory – basics

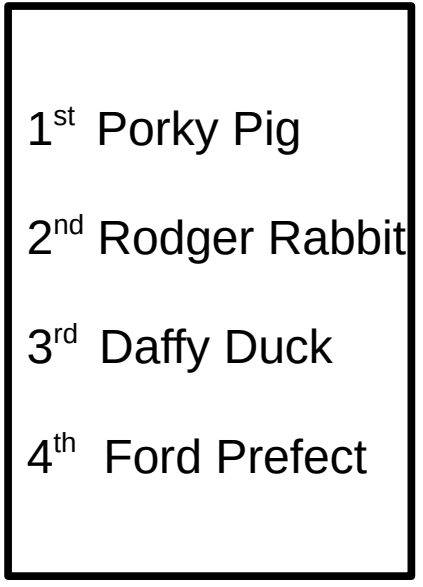
- What we aren’t studying in this chapter
  - Politics
  - Psychology / campaigning
  - The electoral college system
  - Voting machines / how to cast ballots

Voting Theory – basics

- We'll study the logic / mathematics of voting.
- We want an upgraded ballot
  - Ballot is no longer "pick your favorite" but rather "rank the candidates"

Voting Theory – basics

A preference ballot is one person's ranking of all the candidates.



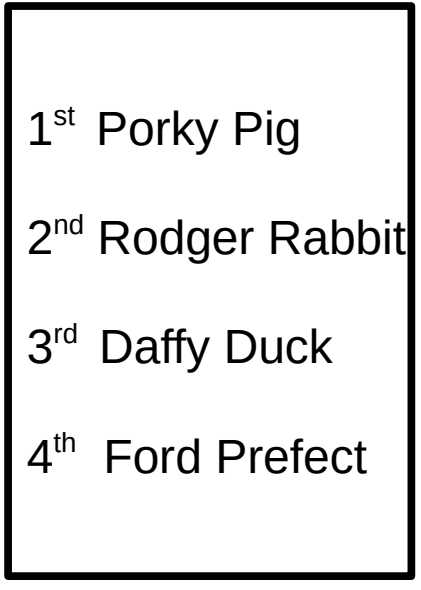
Example Preference Ballot

Voting Theory – basics

A preference ballot is one person's ranking of all the candidates.

A traditional ballot is essentially asking "who's your favorite of all the candidates?"

A preference ballot hasn't lost any information from traditional voting. We are just asking for the ranking of the remaining candidates.



Example Preference Ballot

Voting Theory – basics

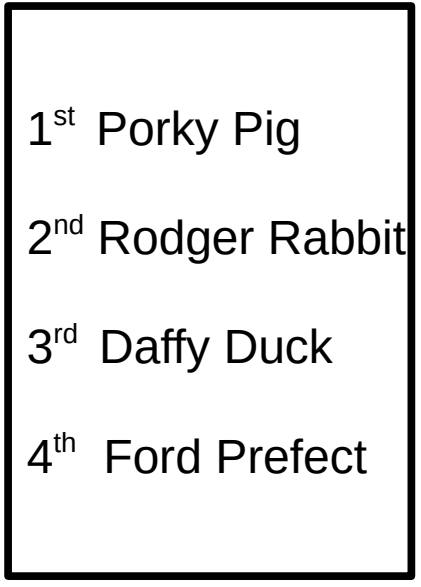
- We haven’t lost any information from traditional voting. (Who’s your favorite?) That’s just asking for the top choice in a preference ballot.

Voting Theory – basics

A preference ballot is one person's ranking of all the candidates.

Assumes transitivity of preference, which is generally a reasonable assumption.

This means that you can put them in a proper ranking where 1st place beats all other places, 2nd place beats everyone but 1st place and so on.



Example Preference Ballot

Voting Theory – basics

Here's an example that isn't transative, i.e. intransitive.

Vlad has to rank 4 activities.

- Vlad prefers Break Dancing over Football.
- Vlad prefers Football over Origami
- Vlad prefers Origami over Break Dancing.
- Vlad prefers anything over Talking to Boomers.

Facts

  - There's no way to put these choices in a ranking. (Try it!)
    - "Talking to Boomers" is the only one action that's rankable.
  - In my experience, people's preferences are transitive.

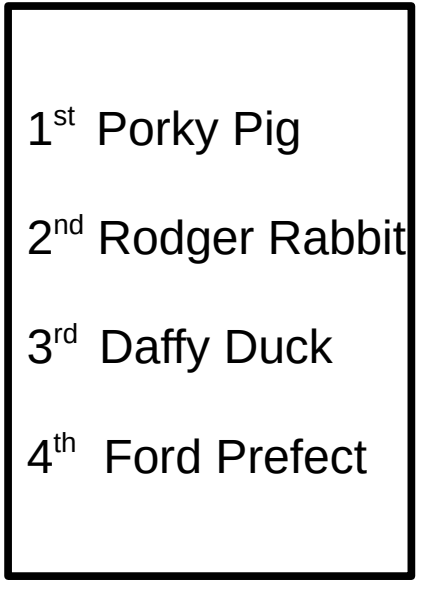
Voting Theory – basics

Here's a visual way of looking at something that's intransitive. Can you order the sticks from front to back? Nope.

Voting Theory – basics

A preference ballot is one person's ranking of all the candidates.

Anyway, we assume that people can put together a ranking like the one to the right.

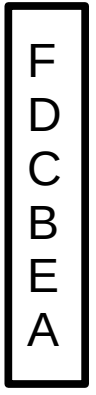


Example Preference Ballot

Voting Theory – basics

In this class, for simplicity, I'll always write preference ballots with the ranking from top to bottom. That is, 1st place is on top, 2nd place is just below 1st, all the way down to last place which is in the bottom row.

Also, because the names aren't germaine to the theory of voting, I'll just use capital letters as candidates. So the ballot to the right shows there are 6 candidates. And this ballot assumes F to be the top choice, D to place 2nd, C to place 3rd, all the way down to candidate A who came in last place, 6th.



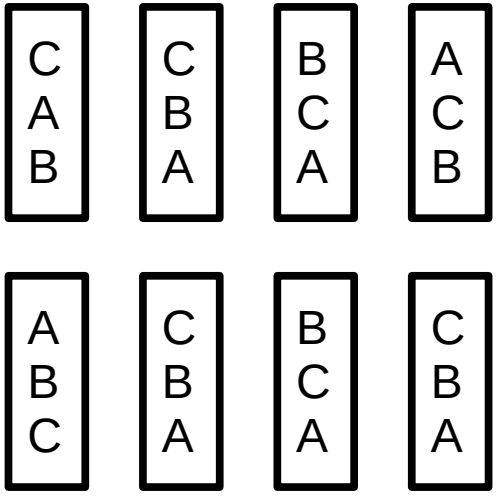
Voting Theory – basics

After all the votes are in, we need a new way of tallying all the preference votes.

We can't just look at first place votes anymore.

Instead we count the number of times each identical preference ballot is encountered. Then we tally it in a table where the count for each ballot is at the top.

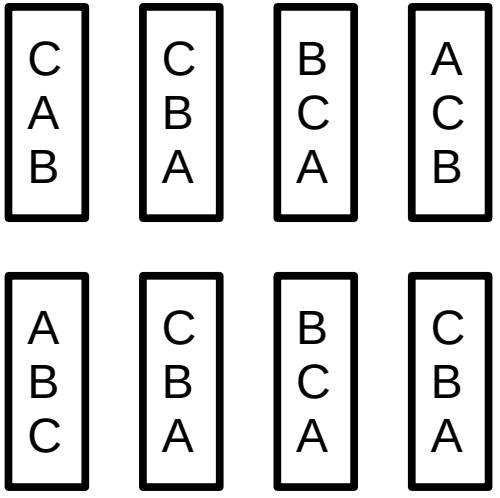
Consider the 8 ballots to the left.



Voting Theory – basics

I see 1 CAB, 3 CBA's, 2 BCA's, 1 ACB, and 1 ABC. (When I write these horizontally, order is left to right)

We will organize the results of the election in a table called a preference schedule, shown on the next slide.



Voting Theory – basics

There were 1 CAB, 3 CBA's, 2 BCA's, 1 ACB, and 1 ABC. Here's the associated preference schedule for such an election. The number at the top is for the count of all ballots that are identical.

3	2	1	1	1
C	B	C	A	A
B	C	A	C	B
A	A	B	B	C

Voting Theory – basics

Consider the preference schedule to the right.

1. How many candidates are in this election?

2. How many voters?

6	4	3	3	1
A	C	B	B	A
C	D	D	C	B
D	B	C	D	C
B	A	A	A	D

Voting Theory – basics

Consider the preference schedule to the right.

1. How many candidates are in this election?

4 Candidates – lovingly named A, B, C and D.

2. How many voters?

6 + 4 + 3 + 3 + 1 = 17 voters.

6	4	3	3	1
A	C	B	B	A
C	D	D	C	B
D	B	C	D	C
B	A	A	A	D

Voting Theory – basics

Consider the preference schedule to the right.

3. How many voters prefer B over all the other candidates?

4. Same question, but for candidate D.

5. If there was an award for the candidate that received the most 3rd place votes, who wins?

6	4	3	3	1
A	C	B	B	A
C	D	D	C	B
D	B	C	D	C
B	A	A	A	D

Voting Theory – basics

3. How many voters prefer B over all the other candidates?

Look at the top row of the preference schedule. You'll see that 3 people voted BDCA and 3 people Voted BADA. So the answer is 6 total.

4. Same question, but for candidate D.

None of the 17 voters placed D at the top. So, zero.

5. If there was an award for the candidate that Received the most 3rd place votes, who wins?

Looks like A got zero, B got 4, C got 4, and D got 9. D wins the prize.

6	4	3	3	1
A	C	B	B	A
C	D	D	C	B
D	B	C	D	C
B	A	A	A	D

Voting Theory – basics