5. Approval Voting and Range Voting

Approval Voting

Approval voting

1. Everyone submits a ballot where they either "approve" of a candidate or "disapprove" of a candidate.
2. Whichever candidate receives the most "approve" votes wins.

Note that *there is no ranking involved*. In particular this is **not a form of ranked choice voting**.

Vote for any number of options.

☐ Joe Smith

☒ John Citizen

☐ Jane Doe

☐ Fred Rubble

☒ Mary Hill

An example approval ballot

Example approval election

Since this is not a ranked choice ballot, our election data looks a little different. Here is an example election:

Candidate	Number of voters					
	6	2	3	4	2	2
Skip	✓		✓	✓		
Norm		✓	✓		✓	
Jesse				✓	✓	✓

We write the candidates on the left column. We see that:
- 6 voters approve of Skip and no one else
- 2 voters approve of Norm and no one else,
- 3 voters approve of Skip and of Norm
- …

Q: Who wins? What is the societal preference order?

A: The votes are:
1. Skip: 13 votes
2. Jesse: 8 votes
3. Norm: 7 votes

Approval voting in the USA

United State Presidential elections are determined by the **electoral college**: that is, there are plurality votes in each state, and generally if a candidate wins a plurality of votes in that state, they gain their electoral votes.

Elector votes from 1800

The first four presidential elections elected Washington (1788, 1792), Adams (1796), and Jefferson (1800). However, the electors voted on the president in a different way.

They used **approval voting**, with each elector getting two votes. Whoever got the most votes became president, and whoever got the second most votes became vice president.

1980 election

In 1980, Jimmy Carter was the incumbent Democratic president, and Ronald Reagan was the Republican challenger. Reagan won the Republican primary with 7.7 million votes, beating out 10 other Republican challengers:

His main two challengers were former CIA director George H.W. Bush (who would become president in 1988) and Illinois congressman John B. Anderson.
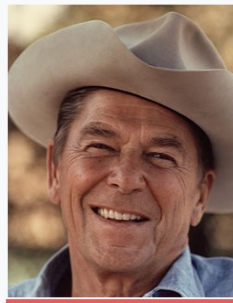
Candidate	Ronald Reagan	George H. W. Bush	John B. Anderson
Home state	California	Texas	Illinois
Contests won	44	6 + DC	0
Popular vote	7,709,793	3,070,033	1,572,174
Percentage	59.8%	23.8%	12.2%

Winning the primary, Reagan tapped Bush to be his vice president, and went on to trounce Carter in the general election.

After the Republican primary, Anderson decided to run as an independent.

He was a more moderate conservative than Reagan, and was deeply critical of the Vietnam War. He had an interesting block of support from moderate conservatives, college students, and even some liberals.

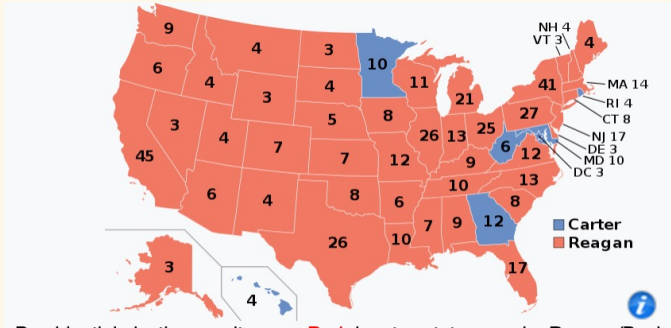Despite this, he wasn't considered by the media to be a viable candidate.
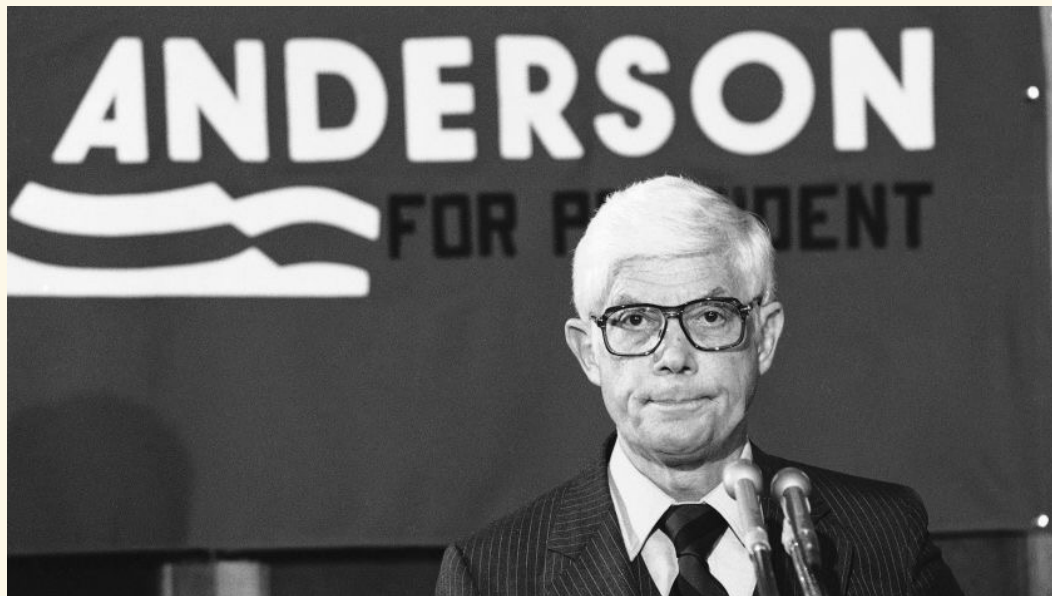
1980 election

The popular vote for the 1980 presidential election came in as follows:

1980 election

US 1980 Presidential Election

Candidate	Votes	Percentage
Ronald Reagan (R)	43,903,230	50.7%
Jimmy Carter (D)	35,480,115	41.0%
John B. Anderson (I)	5,719,850	6.6%

This demonstrates that Anderson was not a serious contender under plurality.

1980 election

Interestingly, a *Time* poll asked voters in October 1980, right before the election, whether they approve or disapprove of each candidate. Their findings were:

Thus we see that **under approval voting**, the 1980 presidential election would have been a much closer contest, with three viable candidates.

Time poll, Oct. 1980

Candidate	Approval
Ronald Reagan (R)	61% approve
Jimmy Carter (D)	57% approve
John B. Anderson (I)	49% approve

Approval voting in politics

1. The United Nations uses a modified form of approval voting (mark "approve", "neutral", or "disapprove") to elect its Secretary General
2. Fargo, North Dakota was the first US city to use approval voting in citywide elections, starting in June 2020.
3. St. Louis, Missouri was the second, starting in March 2021.

Voting criteria for approval voting

Q: Does approval voting satisfy the *majority criterion*?

A: We first have to modify the majority criterion so that it makes sense for approval voting: it would satisfy the criterion if, whenever *a majority of voters approves of a candidate, then that candidate wins*.

It *doesn't* satisfy this criterion. Consider a candidate who 60% of voters approve of. They would lose to another candidate who 70% of voters approve of.

Q: Does it still make sense to talk about a head-to-head contest under approval voting?

A: Yes — in our example election we might just "forget" the row involving Jesse, and we would be left with a head-to-head contest between Skip and Norm.

	Number of voters					
Candidate	**6**	**2**	**3**	**4**	**2**	**2**
Skip	✓		✓	✓		
Norm		✓	✓		✓	
Jesse				✓	✓	✓

Condorcet criteria and approval voting

Discuss: What can we say about Condorcet winners and approval voting? What about the Condorcet winner/loser criteria?

A: (Avoiding ties) if a candidate wins, they they are a Condorcet winner. If a candidate loses, then they are a Condorcet loser.

Thus approval voting satisfies CWC and CLC.

Example: RottenTomatoes

RottenTomatoes is a website which is a *review aggregator*.

The problem with aggregating movie reviews across different platforms is that critics use different rating systems:
- Roger Ebert rated movies out of 4 stars
- AV Club gives a "grade" rating like B+ or C-
- Other websites rate out of 5 or out of 10.

RottenTomatoes combs these websites to see if the reviewer approved of the movie, in which case it is "fresh," or whether they disapproved, in which case the movie is considered "rotten."

Reviewer	Review	Date
M.V. Moorhead *Phoenix Magazine*	I'm not naïve enough to suppose that anything I can say here is likely to change anyone's plans about going or not going, so I'll simply say that I enjoyed this silly but thrilling superhero free-for-all. **Full Review**	January 7, 2020
Phumlani S Langa *City Press (South Africa)*	You would think they would go back to a time when Thanos was young and vulnerable and off him. They opt for a more intricate approach, which bored me. **Full Review** | Original Score: 2/5	January 2, 2020
Daniel Barnes *Sacramento News & Review*	Avengers: Infinity War at least had the good taste to abstain from Jeremy Renner. No such luck in Endgame. **Full Review** | Original Score: 2/5	December 26, 2019

Example: RottenTomatoes

The "score" that RottenTomatoes gives a movie is then what percentage of reviewers approved of the film:

Another way to think about it is that this "0.94" is the **number of approval votes** divided by the **total number of votes**.

So it is some modified form of approval voting.

AVENGERS: ENDGAME

PG-13 2019, Adventure/Fantasy, 3h 1m

94%
TOMATOMETER
541 Reviews

90%
AUDIENCE SCORE
50,000+ Ratings

WHAT TO KNOW

🍅 CRITICS CONSENSUS

Exciting, entertaining, and emotionally impactful, *Avengers: Endgame* does whatever it takes to deliver a satisfying finale to Marvel's epic Infinity Saga. Read critic reviews

Range/score voting

Governor Candidates	Score *each* candidate by filling a number (0 is worst; 9 is best)
1: Candidate A →	**(0)** (1) (2) (3) (4) (5) (6) (7) (8) (9)
2: Candidate B →	(0) (1) (2) (3) (4) (5) (6) (7) (8) **(9)**
3: Candidate C →	(0) (1) (2) (3) (4) (5) (6) **(7)** (8) (9)

Another type of voting, which is similar to approval voting, is called *range voting* or *score voting*.

Rather than saying "approve" or "disapprove," voters give each candidate a score.

Here is an example ballot, where voters would rank candidates from 0 to 9:

Score voting

1. Everyone submits a ballot *scoring* each candidate on a scale (e.g. from 0 to 9).
2. Whichever candidate receives the most points wins.

Range/score voting

For range voting, you don't have to rank a candidate from 0-9. You could have any scale you wanted:
- 1 to 5
- -5 to 17
- any real number between 2 and 3
- etc

Example election: *rank each candidate from 0 to 5.*

Candidate	12	11	7	5	1	1	1
A	5	3	2	0	0	0	0
B	4	5	5	5	3	1	0
C	0	1	5	0	5	5	5

For candidate A:
- 12 people gave them 5 points each, for *60 points*
- 11 prople gave them 3 points each, for *33 points*
- 7 people gave them 2 points each, for *14 points*.

So altogether, A gets **107 points.**

We can compute that B got 167 points, and C got 51 points.

So the resulting **societal preference order** is:

Rank	Candidate	# Points
1	B	167 points
2	A	107 points
3	C	51 points

Examples of score voting

- "Clapometers" are a form of range voting (where candidates get on stage and whoever gets the loudest cheering wins).
- In diving, gymnastics, figure skating, etc. judges will score each candidate based on a rubric and personal opinion. These scores are averaged to determine a final score. This is a form of score voting.

Avengers: Endgame

2019 · PG-13 · 3h 1min

IMDb RATING
★ 8.4/10
895K

YOUR RATING
☆ Rate

Cast & crew · User reviews · Trivia · IMDbPro · 🔲 All to
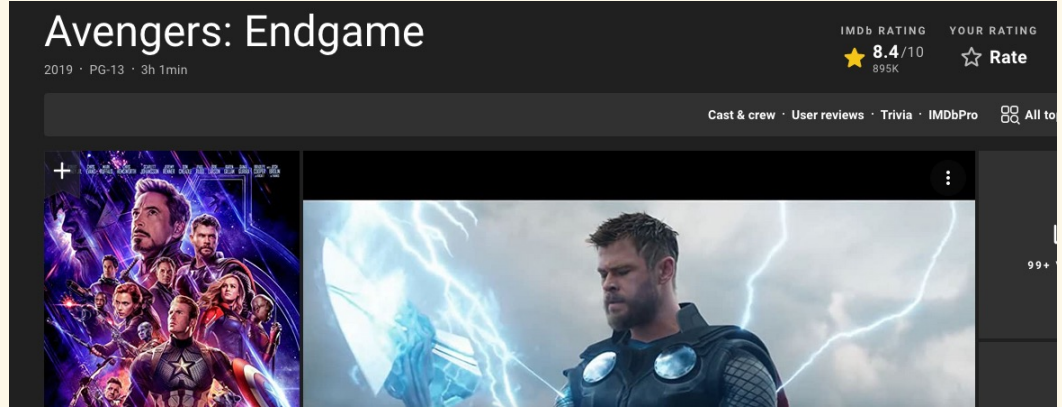
IMDB has a "rating" for each movie out of 10. What does this mean?
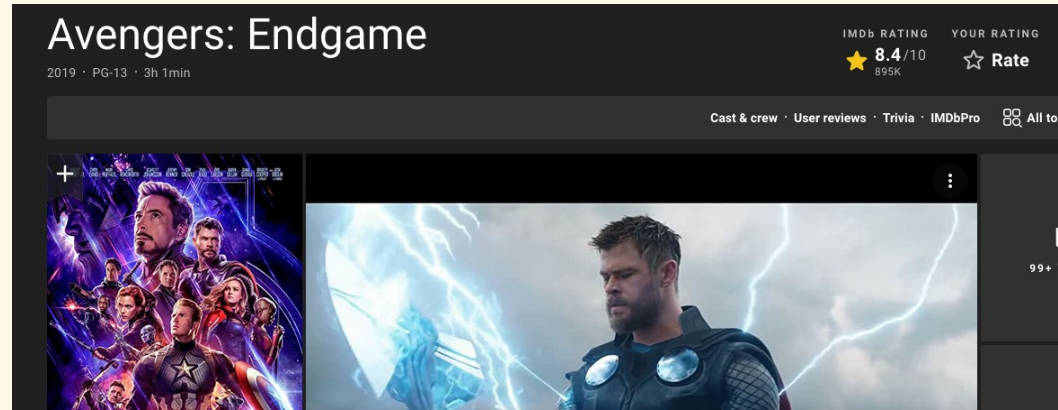
Examples of score voting

Each user ranks the movie from 1 to 10. The "IMDB Rating" is then the total number of points each movie gets, divided by the total number of reviewers.

This is a normalized version of score voting.

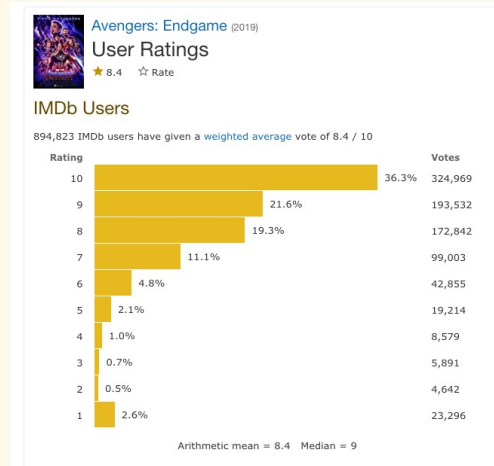Most online reviews (Yelp, Amazon, etc) have a similar rating system.

Approval vs. score

Discuss: Can we view approval voting as a form of score voting?

A: Yes! We can make a score voting system which says "give each candidate either a 0 or a 1." This is a score voting election, but it is also the same as approval voting --- if we view a score of 1 to mean "approve."

Properties of score voting

Q: Is score voting *monotone*? What would that even mean?

Q: Is score voting *Pareto*? What would that even mean?

A: We can take monotonicity to mean: "if some voters give candidate A more points, this won't cause candidate A to drop down on the societal preference order."

In this case score voting **is monotone**.

A: We can take Pareto to mean: "if every voter gives A more points than B, then A is preferred to B in the societal preference order."

In this case score voting **is Pareto**.

Since approval voting is just a form of score voting, this tells us that *approval voting is monotone and Pareto as well*!

Properties of score voting

Does score voting satisfy IIA?

Take a class on game theory/decision theory/economics to learn more!

A: *It depends on what assumptions you make about voters*.

If we assume every voter has weighed all of their options and has done some statistics to calculate expected values of each possible ballot they could submit, it's possible for score voting to fail IIA.

For our purposes, we will assume that score voting satisfies IIA.

Properties of score voting

Q: So score voting is:
- monotonic
- Pareto
- neutral
- and satisfies IIA.

It also isn't a dictatorship.

Doesn't this violate Arrow's theorem?

A: *No!* The fine print of Arrow's theorem said that any *ranked choice* voting system can't satisfy all these properties.

Since score voting is not a ranked choice voting system, it allows you to get around Arrow's theorem!

Discuss:

If you were designing a score voting system, how would your ranking system work?

Would your lowest score start at 0 or at 1? Or at some other number? Would you allow negative scores?

Key Vocab

- Approval voting
- Range/score voting

Exercises

Exercise 1: Does score voting satisfy the majority criterion? What does the majority criterion mean here?

Exercise 2: Design a score voting system. Suppose that a majority of voters want candidate A to win. Can they guarantee A will win by voting a certain way?