

Arrow's Conditions and Approval Voting

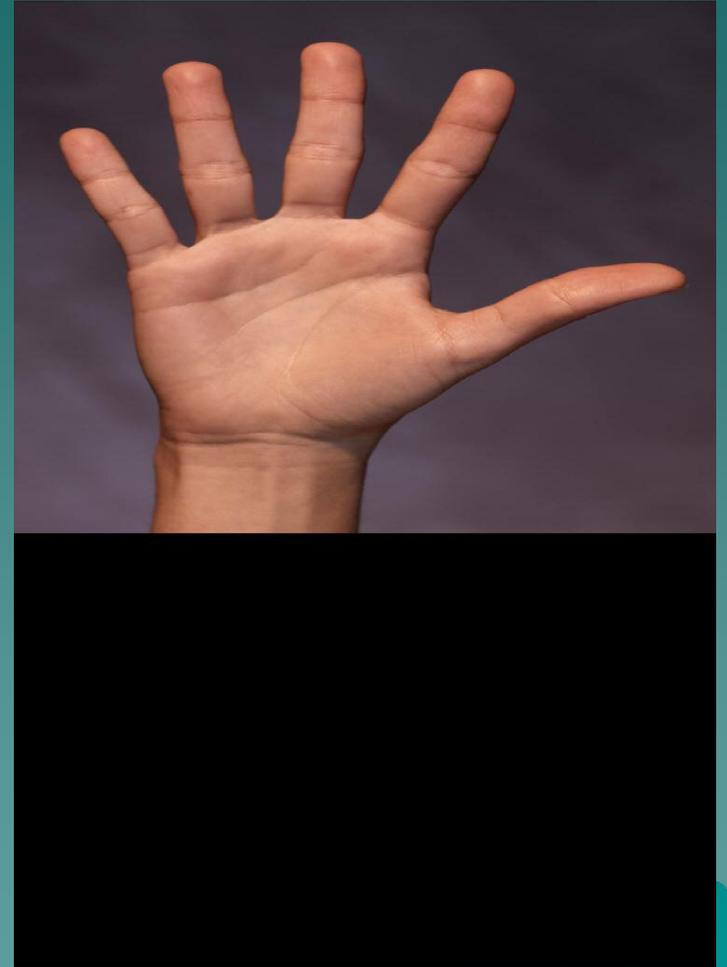
Which group-ranking
method is best?

Paradoxes

- ◆ When a group ranking results in an unexpected winner, the situation is known as a *paradox*.
- ◆ A special type of paradox is the Condorcet paradox.
- ◆ To reduce the chance of paradoxes, an American economist named Kenneth Arrow came up with a list of conditions in 1951.

Arrow's Conditions

- ◆ Arrow's conditions are a list of conditions that are necessary for a fair method determination of group ranking.
- ◆ There are five criteria that must be met.



5 Criteria for Arrow's Conditions

- 1. *Nondictatorship*:** The preferences of a single individual should not become the group ranking without considering the other individuals' preferences.
- 2. *Individual sovereignty*:** Each individual is allowed to order the choices in any way and can indicate ties.



5 Criteria (cont'd)

- 3. *Unanimity*:** If every individual prefers one choice to another, the group ranking should do the same.
- 4. *Freedom from irrelevant alternatives*:** The group ranking between any pair of choices does not depend on the individuals' preference for the remaining choices.

5 Criteria (cont'd)

5. ***Uniqueness of the group***

ranking: The method of producing the group ranking should give the same result whenever it is applied to a given set of preferences. The group ranking must also be transitive.

Application of the Conditions

- ◆ Arrow inspected many of the common methods of determining a group ranking for their adherence to his five criteria. He also looked for new methods that would meet all five. After doing so, he arrived at a surprising conclusion.

Practice Problems

- ◆ We will look at some examples to check their adherence to Arrow's criteria.
- 1. I decide to order soft drinks based on the soft drink vote we took in class, but in doing so I select the preference schedule of Sherrod Alan Chappel, Jr. Which of Arrow's conditions did I violate?

Practice (cont'd)

2. Instead of choosing Sherrod's preference schedule, I place all of the individual preferences in a hat, draw one and orders soft drink based on only that one. If I repeated this method, would the same group ranking result? Which of Arrow's conditions have I violated?

Practice (cont'd)

3. Suppose that there are only two choices in a list of preferences and that the plurality method is used to decide the group ranking. Which of Arrow's conditions could be violated?
4. There often are situations in which insincere voting results, Do any of Arrow's conditions state that insincere voting should not be part of a fair group-ranking procedure?

Development of Approval Voting

- ◆ After failing to find a group-ranking method for 3 or more choices that always obeyed all of his fairness conditions, Arrow began to suspect that such a method might be impossible.
- ◆ He applied logical reasoning to the problem and proved that no method could do so.

Arrow's Conclusions

- ◆ Arrow realized that any group-ranking method will violate at least one of Arrow's conditions in some situations.
- ◆ His proof demonstrated how mathematical reasoning could be applied to areas outside of mathematics.
- ◆ This achievement resulted in Arrow receiving the Nobel Prize for Economics.



Approving Voting



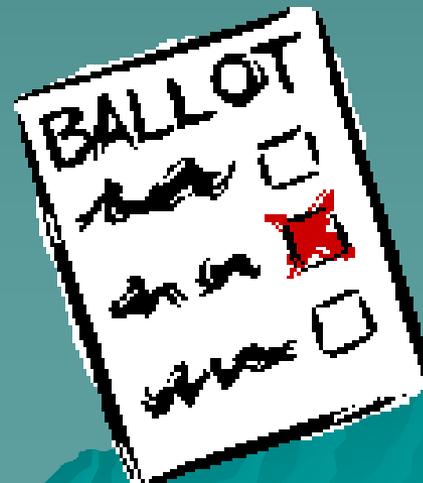
- ◆ Although Arrow realized that we could not find the perfect group ranking situation, that does not mean that we can not continue to improve.
- ◆ This led to studies to find the best group-ranking method.
- ◆ It is believed that ***Approval voting*** is that method.





Approval Voting (cont'd)

- ◆ In approval voting, you may vote for as many choices as you like, but you do not rank them.
- ◆ You mark all those of which you approve.
- ◆ For example, if there are five choices you can vote for as few as none or as many as five.



Let's try this!

- ◆ We will do another soft drink ballot.
- ◆ I want you to place an "X" beside each of the soft drinks that you feel are acceptable.
- ◆ The choices again are:
 - Coke
 - Pepsi
 - Orange Sunkist
 - Dr Pepper
 - Sprite



Determining Group Ranking

- ◆ To determine the group ranking all you have to do is count the number of votes for each soft drinks and determine the winner.
- ◆ The winner will be the drink with the most votes.
- ◆ The second place choice will be the one with the second number of votes and so forth.