

Worksheet 1: Intro to Voting Theory

Group Names: Solutions

1. A class is voting on what kind of ice cream to have. The choices are strawberry (S), chocolate (C), and vanilla (V). The students in the class ranked their ice cream choices as in the following table.

student	Anne	Brian	Charlotte	Dafna	Eric	Frank	Genevieve	Horace	Isaac	Juan	Kate	Layla
1st choice	S	V	S	V	V	S	V	C	C	C	C	V
2nd choice	V	C	V	C	C	C	C	S	V	S	V	C
3rd choice	C	S	C	S	S	V	S	V	S	V	S	S

Possible orders

SVC C SV

SCV C VS

VSC

VCS

- (a) How many possible columns can there be in a preference schedule for this ranking? How many columns does your preference schedule need?

There could be 6 possible columns, but we only need 5 (no one used the ranking VSC)

- (b) Fill in the preference schedule below. Add columns as you need to.

# votes	2	5	1	2	2	
1st choice	S	V	S	C	C	
2nd choice	V	C	C	S	V	
3rd choice	C	S	V	V	S	

- (c) Who is the plurality winner?

1st choices: $S = 2 + 1 = 3$ V wins a plurality!
 $V = 5$
 $C = 2 + 2 = 4$

- (d) How many votes are needed for a majority winner? Is there a majority winner? Explain your answer to a classmate.

Total votes = 12
 majority = $> 50\%$
 $50\% = \frac{12}{2} = 6$, but we need more than 50%. so a majority requires at least 7 votes.

- (e) Do you think the plurality winner accurately represents the class's preference for ice cream? Explain your answer in a sentence or two.

More people preferred "anything but vanilla" to vanilla for their first choice, so I don't think "vanilla" accurately reflects the overall preference. ($\frac{5}{12} \approx 42\%$)

2. A group of 42 moviegoers is asked to rank the following three movies: “Inside out 2”, “Deadpool and Wolverine”, and “Despicable Me 4”. Their results are provided in the following preference schedule:

number of voters	14	9	8	5	6
1st choice	Deadpool	Despicable Me	Inside Out	Inside Out	Despicable Me
2nd choice	Inside Out	Deadpool	Deadpool	Despicable Me	Inside Out
3rd choice	Despicable Me	Inside Out	Despicable Me	Deadpool	Deadpool

- (a) How many voters were there? 42
- (b) How many voters are needed to have a majority of the votes? 22 Why?
 $\frac{42}{2} = 21$, so we need $21 + 1$ for a majority
- (c) What is the minimum number of votes needed for a movie to have a plurality of the votes? 15 Why? Need 15 votes for a plurality
 3 choices \Rightarrow Someone needs to get $> 42/3 = 14$
- (d) Find the winner using **Plurality Voting**, if one exists. Write a sentence to explain your answer to a classmate.
 DP = 14 IO = 8 + 5 = 13 DM is the plurality winner because it got the most first-place votes.
 DM = 9 + 6 = 15
- (e) Is there a **Condorcet winner**? Show some work and explain your answer. Compare your answer to your answer from (d) about a plurality winner.

Check all head-to-head matchups.

DP vs DM

22 vs 20

number of voters	14	9	8	5	6
1st choice	Deadpool	Despicable Me	Inside Out	Inside Out	Despicable Me
2nd choice	Inside Out	Deadpool	Deadpool	Despicable Me	Inside Out
3rd choice	Despicable Me	Inside Out	Despicable Me	Deadpool	Deadpool

DP vs. IO

23 vs 19

number of voters	14	9	8	5	6
1st choice	Deadpool	Despicable Me	Inside Out	Inside Out	Despicable Me
2nd choice	Inside Out	Deadpool	Deadpool	Despicable Me	Inside Out
3rd choice	Despicable Me	Inside Out	Despicable Me	Deadpool	Deadpool

DM vs IO

27 vs 15

number of voters	14	9	8	5	6
1st choice	Deadpool	Despicable Me	Inside Out	Inside Out	Despicable Me
2nd choice	Inside Out	Deadpool	Deadpool	Despicable Me	Inside Out
3rd choice	Despicable Me	Inside Out	Despicable Me	Deadpool	Deadpool

• The plurality winner of this contest won

NONE of the head-to-head matchups!

• Deadpool is the Condorcet winner