Name: __Key__

1. (a) Convert this set of ballots into a preference schedule.

	Alex	Blair	Casey	Devin	Emerson	Gabrielle	Lee	Marcus	Taylor
1st	Ovid's	Ovid's	Ovid's	Ovid's	Subway	Subway	Fazoli's	Fazoli's	Panera
2nd	K-Lair	K-Lair	K-Lair	K-Lair	Panera	Panera	Subway	Subway	K-Lair
3rd	Fazoli's	Fazoli's	Fazoli's	Fazoli's	Fazoli's	Fazoli's	Panera	Panera	Subway
4th	Panera	Panera	Panera	Panera	K-Lair	K-Lair	Ovid's	Ovid's	Ovid's
5th	Subway	Subway	Subway	Subway	Ovid's	Ovid's	K-Lair	K-Lair	Fazoli's

4	2	2	1
O	S	F	P
K	P	S	K
F	F	P	S
P	K	O	O
S	O	K	F

$\left[9 \text{ total Voters} \right]$

(b) How many voters are needed to form a majority in this election?

5 (more than half)

(c) If you eliminate Panera, what does the new preference schedule look like?

4	2	2	1
O	S	F	K
K	F	S	S
F	K	O	O
S	O	K	F

(d) In a Fazoli's versus Panera head-to-head matchup, whose votes does each restaurant get?

F vs P $\left[5 \text{ to } 3 \right]$

F: A L B M C D

P: E G T

(e) Name one restaurant that is NOT a Condorcet winner. Explain why.

Panera. It lost against Fazoli's

2. Here is a preference schedule.

	4	2	2	1
1st	O	S	F	P
2nd	K	P	S	K
3rd	F	F	P	S
4th	P	K	O	O
5th	S	O	K	F

(a) Show work: Who wins using plurality?

1st 2nd
O 4 ☺
K 0
F 2
P 1
S 2

Ovid's

(b) Show work: Who wins using plurality with elimination?

Subway!

K-Lair Eliminated first
Panera Eliminated next (S gets +1 vote)
Fazoli's Eliminated next (S gets +2 vote)
Ovid's Eliminated last (S gets +4 votes, all of them)

(c) Show work: Who wins using pairwise comparison?

Pairwise comparison:

O vs K 6 vs 3   K vs F 5 vs 4   F vs P 6 vs 3   O 2 wins   Panera!
O vs F 5 vs 4   K vs P 4 vs 5   F vs S 6 vs 3   K 2 wins
O vs P 4 vs 5   K vs S 5 vs 4   P vs S 5 vs 4   F 2 wins
O vs S 4 vs 5   P 3 wins ☺
                                                    S 1 win

(d) Show work: Who wins using Thomas's rule = Borda count?

	1st	2nd	3rd	4th	5th
O	4	0	0	2+1	2
K	0	4+1	0	2	2
F	2	0	4+2	0	1
P	1	2	2	4	0
S	2	2	1	0	4

Fazoli's!

4(5) + 3(2) + 2 = 28
5(4) + 2(1) + 2 = 26
2(5) + 6(3) + 1 = 29 ☺
1(5) + 2(4) + 2(3) + 4 = 27
2(5) + 2(4) + 1(3) + 4 = 25

(e) Show work: Who wins using Daisia's rule?

O 4
K 5 ☺
F 2
P 3
S 4

K-Lair

3. (a) Plurality declares Ovid's the winner of this election. Which fairness criterion does this violate and why?

	3	2	2
1st	Ovid's	K-Lair	Subway
2nd	K-Lair	Subway	K-Lair
3rd	Subway	Ovid's	Ovid's

Condorcet. K-Lair is CW
(K vs O: 2+2 vs 3; K vs S: 3+2 vs 2)
but Ovid's wins instead.

(Not a violation
of Anon, Neut, Mono
Maj. or IIA)

(b) Plurality declares Ovid's the winner of the top election, but K-Lair the winner of the bottom election. Which fairness criterion does this violate and why?

	4	3	2
1st	Ovid's	Subway	K-Lair
2nd	Subway	K-Lair	Ovid's
3rd	K-Lair	Ovid's	Subway

	4	3	2
1st	Ovid's	K-Lair	K-Lair
2nd	K-Lair	Ovid's	Ovid's

IIA. Subway loses, but if
it is eliminated, the winner
changes

Subway spoils it for K-Lair
by Entering, or for Ovid's by
leaving.

(Not a violation
of Con, Anon, Neut,
Mono, Maj, ~~or IIA~~)

(c) Plurality with Elimination declares Ovid's the winner of the top election, but Subway is the winner of the bottom election. Which fairness criterion does this violate and why?

	Jordan	Jared	6 more	5	4
1st	Subway	Subway	Subway	Ovid's	K-Lair
2nd	Ovid's	Ovid's	Ovid's	Subway	Ovid's
3rd	K-Lair	K-Lair	K-Lair	K-Lair	Subway

	Jordan	Jared	6 more	5	4
1st	K-Lair	K-Lair	Subway	Ovid's	K-Lair
2nd	Ovid's	Ovid's	Ovid's	Subway	Ovid's
3rd	Subway	Subway	K-Lair	K-Lair	Subway

Monotone. Subway wins
bottom, but if J+J
change their vote to
be for subway (like in
the top), then subway
loses.

(Not a violation
of Con, Maj, Anon,
Neut, ~~Mono~~ IIA)

4. (a) Construct an example of a preference schedule where plurality disagrees with one of the other methods [name the other method, say who won both methods, and explain "how" you figured out your example].

#2 works.   [For example]

(b) Pick one of the fairness criteria we discussed in class. Explain what it means and name one voting method that violates it.

Condorcet - If K-Lair wins every head-to-head, it should win, but Ovid's wins #3a. [For example.]

(c) Why is a restaurant with more than half of the first place votes always a Condorcet winner?

With more than half 1st place, always have more than half in a head-to-head, so always wins every head-to-head.

Name: **Key**

1. (a) Convert this set of ballots into a preference schedule.

	Alex	Blair	Casey	Devin	Emerson	Gabrielle	Henry	Ivy	Lee	Marcus	Taylor
1st	K-Lair	K-Lair	K-Lair	K-Lair	K-Lair	Panera	Panera	Panera	Subway	Subway	Fazoli's
2nd	Ovid's	Ovid's	Ovid's	Ovid's	Ovid's	Fazoli's	Fazoli's	Fazoli's	Panera	Panera	Ovid's
3rd	Subway	Subway	Subway	Subway	Subway	Subway	Subway	Subway	Fazoli's	Fazoli's	Panera
4th	Fazoli's	Fazoli's	Fazoli's	Fazoli's	Fazoli's	Ovid's	Ovid's	Ovid's	K-Lair	K-Lair	K-Lair
5th	Panera	Panera	Panera	Panera	Panera	K-Lair	K-Lair	K-Lair	Ovid's	Ovid's	Subway

```
5  3  2  1
K  P  S  F
O  F  P  O
S  S  F  P
F  O  K  K
P  K  O  S
```

11 total voters

(b) How many voters are needed to form a majority in this election?

6, more than half

(c) If you eliminate Fazoli's, what does the new preference schedule look like?

```
5  3  2  1
K  P  S  O
O  S  P  P
S  O  K  K
P  K  O  S
```

(d) In a Subway versus Fazoli's head-to-head matchup, whose votes does each restaurant get?

```
S  vs  F      [ 7 vs 4 ]
A      L   G
B      M   H
C          I
D          T
E
```

(e) Name one restaurant that is NOT a Condorcet winner. Explain why.

Fazoli's. {They lost against Subway, but a Condorcet winner never loses a head-to-head matchup.

2. Here is a preference schedule.

(a) Show work: Who wins using plurality?

	5	3	2	1
1st	K	P	S	F
2nd	O	F	P	O
3rd	S	S	F	P
4th	F	O	K	K
5th	P	K	O	S

1st
K 5 ☺   K-Lair
O 0
S 2
F 1
P 3

(b) Show work: Who wins using plurality with elimination?

Ovid's eliminated first (no change in votes)   P
F eliminated next (~~Ovid's~~ gets +1)   Panera
S eliminated next   P
K eliminated last   (P gets +2)
                       (P gets +5, ●11 total)

(c) Show work: Who wins using pairwise comparison?

Ⓚ vs O | F vs Ⓟ | K vs Ⓢ | K vs Ⓕ | K vs Ⓟ | Ⓞ vs S | Ⓞ vs F | Ⓞ vs P | Ⓢ vs F
7   4 | 6   5 | 6   5 | 5   6 | 5   6 | 6   5 | 5   6 | 6   5 | 7 4
                          ☺   ☺   ☺   ☺   ☺   ☺

K 2 wins, O 2 wins, F 3 wins, S 2 wins, P 1 win   Fazoli's
                              ☺

(d) Show work: Who wins using Thomas's rule = Borda count?

	1st	2nd	3rd	4th	5th	BC		
K	5	0	0	3	3	5(5) + 3(2) + 3	34	Subway
O	0	6	0	3	2	6(4) + 3(2) + 2	32	
S	2	0	8	6	1	2(5) + 8(3) + 1	35 ☺	
F	1	3	2	5	0	1(5) + 3(4) + 2(3) + 5(2)	33	
P	3	2	1	0	5	3(5) + 2(4) + 1(3) + 5	31	

(e) Show work: Who wins using Daisia's rule?

K 5
O 6 ☺   Ovid's
S 2
F 1+3
P 3+2

3. (a) Plurality declares Ovid's the winner of this election. Which fairness criterion does this violate and why?

	3	2	2
1st	Ovid's	K-Lair	Subway
2nd	K-Lair	Subway	K-Lair
3rd	Subway	Ovid's	Ovid's

(b) Plurality declares Ovid's the winner of the top election, but K-Lair the winner of the bottom election. Which fairness criterion does this violate and why?

	4	3	2
1st	Ovid's	Subway	K-Lair
2nd	Subway	K-Lair	Ovid's
3rd	K-Lair	Ovid's	Subway

	4	3	2
1st	Ovid's	K-Lair	K-Lair
2nd	K-Lair	Ovid's	Ovid's

(c) Plurality with Elimination declares Ovid's the winner of the top election, but Subway is the winner of the bottom election. Which fairness criterion does this violate and why?

	Jordan	Jared	6 more	5	4
1st	Subway	Subway	Subway	Ovid's	K-Lair
2nd	Ovid's	Ovid's	Ovid's	Subway	Ovid's
3rd	K-Lair	K-Lair	K-Lair	K-Lair	Subway

	Jordan	Jared	6 more	5	4
1st	K-Lair	K-Lair	Subway	Ovid's	K-Lair
2nd	Ovid's	Ovid's	Ovid's	Subway	Ovid's
3rd	Subway	Subway	K-Lair	K-Lair	Subway

4. (a) Construct an example of a preference schedule where plurality disagrees with one of the other methods [name the other method, say who won both methods, and explain "how" you figured out your example].

(b) Pick one of the fairness criteria we discussed in class. Explain what it means and name one voting method that violates it.

(c) Why does a restaurant with more than half of the first place votes always win a plurality election?

Plurality only looks at 1st Place votes. If Ovid's has 51%, everyone else is sharing 49%, so all have less than 51%, less than Ovid's.