Math 101 Practice First Midterm

The actual midterm will be much shorter. You should also study your notes, the textbook, and the homework.

Answers are on the last page.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

For an election with four candidates (A, B, C, and D) we have the following preference schedule:

Number of Voters	6	3	5	8
1st choice	D	D	A	C
2nd choice	B	A	C	A
3rd choice	A	B	B	D
4th choice	C	C	D	B

1) Using the plurality method, which candidate wins the election? 1) _____

A) A B) B C) C D) D

2) Using the Borda count method, which candidate wins the election? 2) _____

A) A B) B C) C D) D

3) Using the plurality–with–elimination method, which candidate wins the election? 3) _____

A) A
B) B
C) C
D) D
E) None of the above

4) Using the method of pairwise comparisons, which candidate wins the election? 4) _____

A) A
B) B
C) C
D) D
E) None of the above

5) In this election, 5) _____

A) B is a Condorcet candidate.
B) A is a Condorcet candidate.
C) every candidate is a Condorcet candidate.
D) there is no Condorcet candidate.
E) None of the above

6) The ranking of the candidates using the extended plurality method is 6) _____

A) first: D; second: C; third: A; fourth: B.

B) first: D; second: A; third: B; fourth: C.

C) first: D; second: A; third: C; fourth: B.

D) first: C; second: D; third: A; fourth: B.

E) None of the above

7) The ranking of the candidates using the extended plurality–with–elimination method is 7) _____

A) first: C; second: D; third: A; fourth: B.

B) first: C; second: A; third: B; fourth: D.

C) first: D; second: C; third: A; fourth: B.

D) first: C; second: A; third: D; fourth: B.

E) None of the above

8) The ranking of the candidates using the extended Borda count method is 8) _____

A) first: A; second: C; third: D; fourth: B.

B) first: D; second: A; third: C; fourth: B.

C) first: D; second: C; third: A; fourth: B.

D) first: A; second: D; third: C; fourth: B.

E) None of the above

9) The ranking of the candidates using the extended pairwise comparisons method is 9) _____

A) first: D; second: A; third: C; fourth: B.

B) first: D; second: C; third: A; fourth: B.

C) first: A; second: C; third: D; fourth: B.

D) first: A; second: D; third: C; fourth: B.

E) None of the above

Solve the problem.

10) An election is held among four candidates (A, B, C, and D). Using a voting method we will call X, the winner of the election is candidate A. Due to an irregularity in the original vote count, a recount is required. Before the recount takes place, candidate B drops out of the race. In the recount, still using voting method X, candidate D wins the election. Based on this information, we can say that voting method X violates the 10) _____

A) independence of irrelevant alternatives criterion.

B) monotonicity criterion.

C) Condorcet criterion.

D) majority criterion.

E) None of the above

11) An election is held among four candidates (A, B, C, and D). Using a voting method we will call X, the winner of the election is candidate A. However, candidate D beats each other candidate in a head to head, pairwise comparison. Based on this information, we can say that voting method X violates the 11) _____

A) independence of irrelevant alternatives criterion.

B) majority criterion.

C) Condorcet criterion.

D) monotonicity criterion.

E) None of the above

12) Arrow's Impossibility Theorem implies 12) _____

A) that it is impossible to have a voting method that satisfies all four of the fairness criteria.

B) that in every election, no matter what voting method we use, at least one of the four fairness criteria will be violated.

C) that every voting method can potentially violate each one of the four fairness criteria.

D) that in every election, each of the voting methods must produce a different winner.

E) None of the above

13) An election is held among five candidates (A, B, C, D, and E) and A gets a majority of the first place votes but B wins the election. Which of the following methods could have been the method used to decide this election? 13) _____

A) The plurality–with–elimination method

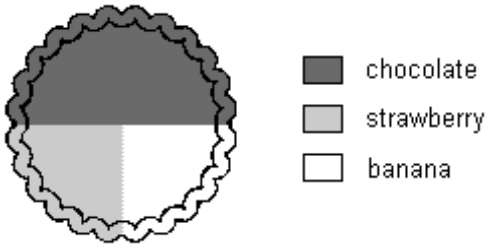
B) The Borda count method

C) The method of pairwise comparisons

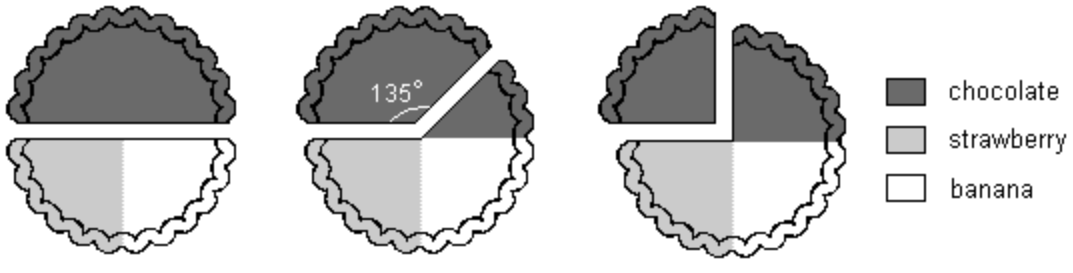
D) All of the above

E) None of the above

Carli and Dale want to divide fairly the chocolate–strawberry cake shown below using the divider–chooser method. The total cost of the cake was $18.00. Carli values strawberry and banana equally, but values chocolate twice as much as either of these put together. Dale values chocolate three times as much as he values strawberry. Further, he values strawberry twice as much as he values banana.



14) If Carli is the divider, which of the divisions shown below is consistent with Carli's value system? 14) _____



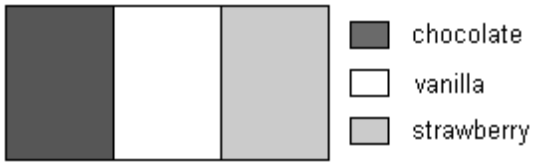
A) Division 1
B) Division 2
C) Division 3
D) All of the above
E) None of the above

Three players (one divider and two choosers) are going to divide a cake fairly using the lone divider method. The divider cuts the cake into three slices (s_1, s_2, and s_3).

15) If the choosers' declarations are Chooser 1: {s_2 , s_3} and Chooser 2: {s_1 , s_3}, which of the following is not a fair division of the cake? 15) _____

A) Chooser 1 gets s_2; Chooser 2 gets s_1;Divider gets s_3.
B) Chooser 1 gets s_1; Chooser 2 gets s_3; Divider gets s_2.
C) Chooser 1 gets s_2; Chooser 2 gets s_3; Divider gets s_1.
D) Chooser 1 gets s_3; Chooser 2 gets s_1; Divider gets s_2.
E) None of the above

Don, Dale, and Cam buy a carton of neopolitan ice cream that is one–third chocolate, one–third vanilla, and one–third strawberry as shown below. They wish to fairly divide the ice cream using the lone chooser method. Don likes chocolate twice as much as vanilla or strawberry. Dale likes strawberry but no other flavor. Cam, the chooser, likes chocolate and vanilla twice as much as strawberry. In the first division, Don cuts the chocolate piece off and lets Dale choose his favorite piece. Based on that, Dale chooses the vanilla and strawberry parts. Note: All cuts made to the ice cream shown below are vertical.



16) Which is a second division that Dale would make of his share of the ice cream? 16) _____

A) Part 1: the strawberry, Part 2: $\frac{1}{2}$ of the vanilla, Part 3: $\frac{1}{2}$ of the vanilla

B) Part 1: $\frac{2}{3}$ of the vanilla, Part 2: $\frac{2}{3}$ of the strawberry, Part 3: $\frac{1}{3}$ of the vanilla and $\frac{1}{3}$ of the strawberry

C) Part 1: the vanilla, Part 2: $\frac{1}{2}$ of the strawberry, Part 3: $\frac{1}{2}$ of the strawberry

D) Part 1: the vanilla and $\frac{1}{3}$ of the strawberry, Part 2: $\frac{1}{3}$ of the strawberry, Part 3: $\frac{1}{3}$ of the strawberry

E) None of the above

A cake valued at \$18 is divided among six players (P_1, P_2, P_3, P_4, P_5, and P_6) using the last–diminisher method. The players play in a fixed order, with P_1 first, P_2 second, etc... . In round 1, P_1 makes the first cut, and makes a claim on a C–piece. For each of the remaining players, the value of the current C–piece at the time it is their turn to play is given in the following table.

	P_2	P_3	P_4	P_5	P_6
Value of current C–piece	**\$5.00**	**\$2.25**	**\$2.00**	**\$3.00**	**\$4.50**

17) Which player gets his share at the end of round 1? 17) _____

A) P_2

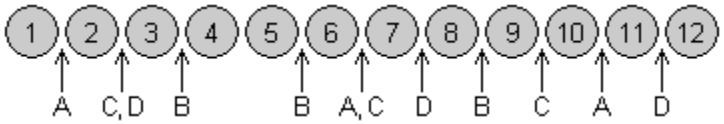
B) P_1

C) P_6

D) P_5

E) None of the above

Four players (A, B, C, and D) agree to divide the 12 items below using the method of markers. The players' bids are as indicated.



18) Item 5 18) _____

A) goes to D.
B) is left over.
C) goes to B.
D) goes to C.
E) goes to A.

19) Item 10 19) _____

A) goes to A.
B) goes to B.
C) goes to C.
D) goes to D.
E) is left over.

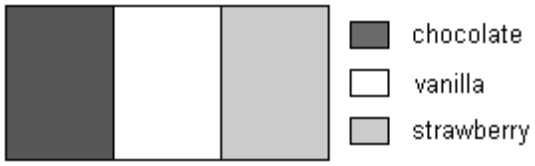
Four heirs (A, B, C, and D) must divide fairly an estate consisting of three items — a house, a cabin and a boat — using the method of sealed bids. The players' bids (in dollars) are:

	A	B	C	D
House	**180,000**	**200,000**	**190,000**	**185,000**
Cabin	**60,000**	**50,000**	**40,000**	**55,000**
Boat	**16,000**	**12,000**	**18,000**	**10,000**

20) After all is said and done, the final allocation to player B is 20) _____

A) the house plus $6000 in cash.
B) the house minus $128,500 in cash.
C) $65,500 in cash.
D) the house minus $134,500 in cash.
E) None of the above

Don, Dale, and Cam buy a carton of neopolitan ice cream that is one–third chocolate, one–third vanilla, and one–third strawberry as shown below. They wish to fairly divide the ice cream using the lone chooser method. Don likes chocolate twice as much as vanilla or strawberry. Dale likes strawberry but no other flavor. Cam, the chooser, likes chocolate and vanilla twice as much as strawberry. In the first division, Don cuts the chocolate piece off and lets Dale choose his favorite piece. Based on that, Dale chooses the vanilla and strawberry parts. Note: All cuts made to the ice cream shown below are vertical.



21) What pieces does Cam choose based on the other player's divisions? 21) _____

A) $\frac{1}{3}$ of the chocolate, $\frac{1}{3}$ of the vanilla, and $\frac{1}{3}$ of the strawberry

B) $\frac{1}{3}$ of the chocolate, $\frac{1}{2}$ of the vanilla, and $\frac{1}{2}$ of the strawberry

C) $\frac{1}{3}$ of the chocolate and all of the vanilla

D) $\frac{1}{3}$ of the chocolate, all of the vanilla, and $\frac{1}{3}$ of the strawberry

E) None of the above

Solve the problem.

22) Which of the following is a discrete fair division problem? 22) _____

A) Dividing a tropical island.

B) Dividing a cheese pizza.

C) Dividing a gallon of ice cream.

D) Dividing an antique car collection.

E) None of the above

23) Which of the following is a continuous fair division problem? 23) _____

A) Dividing the family jewels.

B) Dividing an art collection.

C) Dividing a house plus all the furniture in it.

D) Dividing a cream pie.

E) None of the above

24) Joe and Bill want to divide a cake using the divider–chooser method. They draw straws, and it is determined that Bill will be the divider and Joe the chooser. Assuming that each plays the game correctly, which of the following statements [A), B), C) or D)] cannot be true? 24) _____

A) Bill believes that Joe's share is worth 50% of the cake; Joe believes that his share is worth 60% of the cake.

B) Bill believes that his share is worth 60% of the cake; Joe believes that his share is worth 50% of the cake.

C) Joe believes that his share is worth 50% of the cake; Bill believes that his share is worth 50% of the cake.

D) Joe believes that his share is worth 60% of the cake; Bill believes that his share is worth 50% of the cake.

E) None of the above

Answer Key
Testname: PRACTICEMT1

1) D
2) A
3) C
4) A
5) B
6) A
7) A
8) D
9) C
10) A
11) C
12) A
13) B
14) B
15) B
16) D
17) C
18) C
19) E
20) B
21) D
22) D
23) D
24) B