Math 111 - Midterm 2 Review Problems

Most of these problems do not need a calculator. Remember, you will not be allowed to use a calculator on the test.

1. Use the following preference schedule to answer the questions below.

Class President Preferences			
Number of voters	**11**	**10**	**7**
1st choice	Alice	Bob	Carmen
2nd choice	Carmen	Carmen	Bob
3rd choice	Bob	Alice	Alice

   (a) How many people prefer Bob as their second choice?

   (b) In a head to head competition between Alice and Bob, who would get more votes?

   (c) Is there a Condorcet candidate? Explain.

   (d) Who would win the election using the Borda count method?

   (e) Which candidate would be the first person eliminated in Instant Run-Off Voting?

2. Which is the only one of the following voting methods that will always elect a Condorcet candidate: Plurality, Borda Count, Instant Run-Off, or Pairwise Comparisons?

3. Which voting method can fail the Monotonicity criteria?

4. Suppose that in 2000, Ralph Nader had dropped out of the election and Al Gore won. This would be an example of a violation of which fairness criterion?

5. New Jersey contains 2.85% of the United States population. What is New Jersey's standard quota of the 435 seats in the house of representatives.

6. If the U.S. population was 435 million, what would the standard divisor be for the 435 seats in the House of Representatives? What would the standard divisor represent?

7. Explain what the Alabama paradox is. In what year did the original Alabama paradox occur?

8. Which is the only apportionment method where the Alabama paradox is a problem?

9. Suppose that a company needs to apportion a shipment of new 60 computers to its 4 different sites (A, B, C, and D), and the company determines that the standard quotas for the sites are:

Site	A	B	C	D
Quota	5.53	17.61	23.79	13.07

   How many computers will each site receive if we use Hamilton's method?

10. A small town has four bus routes. The average number of passengers for each bus route is listed below. The town has 20 buses and would like to apportion the buses so that each route gets a number of buses proportional to the average number of riders.

Bus Routes				
Route	**A**	**B**	**C**	**D**
Average # of riders	432	272	831	465

(a) In this apportionment problem, what are the "seats" and what are the "states"?

(b) What is the total population?

(c) What is the standard divisor?

11. The standard quota for Texas is 35.4 seats. Explain why Texas could not possibly receive 34 seats in Congress if we used Jefferson's method.

12. Suppose you are selecting a lunch at a restaurant. You may select either a soup and salad combination or a sandwich. If there are 3 soups, 4 salads, and 8 sandwiches available, how many different lunch combinations are possible?

13. What is the probability of flipping a coin 4 times and getting 3 or more heads?

14. (a) A basketball coach has 12 players on his team. How many ways can the coach choose 5 starters for the next game?

(b) A baseball coach has to choose the batting order for the 9 players on his team. How many ways can he do this?

15. A box contains a red ball, a blue ball, and a green ball. A ball is drawn at random and then replaced. A second ball is then drawn at random.

(a) Show all the possible outcomes using a tree diagram.

(b) What is the probability that you draw a red ball both times?

(c) Calculate the probability of getting one blue and one red ball.

16. Suppose that you flip an unfair coin that lands on heads 90% of the time. Make a tree diagram for the possible outcomes of flipping the coin twice, and find the probability of each outcome.

17. If I flip a fair coin four times in a row, and then write down the total number of times it landed heads, what is the sample space? Is this an equiprobable space?

18. Find the following without a calculator.

(a) ${}_5C_4$

(b) ${}_5P_4$

(c) ${}_{50}C_{48}$

19. A die is rolled and a coin is tossed. Find each probability.

(a) The die shows a 2 and the coin shows a tail.

(b) The die shows a 4 or 5 and the coin shows heads.

20. The scoring for a college course is given in the following table.

	Exam 1	Exam 2	Exam 3	In-Class	Paper	Final Exam
Weight	15%	15%	15%	10%	25%	20%
Bob's scores	77	83	91	90	87	?

What grade would Bob need on the final exam to get an 83 in the course?

21. Find the expected value of a random variable with four possible outcomes and probabilities shown below.

Outcome	-1	0	4	10
Probability	0.1	0.25	0.25	?

22. A class of history students received the following quiz scores. Draw a histogram for the data below.

Score	0	1	2	3	4	5	6	7	8	9	10
Frequency	0	0	2	0	0	3	2	3	5	2	3