Math 111 - Midterm 2 Review Problems

Most of these problems do not need a calculator. The ones where a calculator is needed say so. Remember, you will not be allowed to use a calculator on the test.

1. Convert the following growth factors into percentage changes. Be sure to indicate if it is a percentage increase or decrease.
   (a) Quadruple
   (b) 1.3
   (c) 0.4
   (d) 2.7

2. Suppose that you put \$1200 in a savings account that pays 2% APR compounded monthly. Write down a formula for how much money you will have in that account after 10 years. You do not need to simplify your answer.

3. Suppose that my investment portfolio grows 10% one year, and then declines 10% the next year. Calculate the total percentage change in my investments (without a calculator).

4. What are the first 4 rows of Pascal's triangle?

5. Use the Binomial Theorem to find $(1.01)^4$ without a calculator.

6. 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.

7. 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?

8. Which is the only apportionment method (that we have discussed) where the Alabama paradox is a problem?

9. Suppose that a company needs to apportion a shipment of 20 new computers to its 4 different sites (A, B, C, and D). After adjusting the divisor, they arrive at the following adjusted quotas:

Site	A	B	C	D
Adjusted Quota	3.6	2.9	10.5	5.3

   (a) If we are using Jefferson's method to apportion the computers, will we need to adjust the divisor again, or are we done? If we are done, then what is the final apportionment? If we are not, will we need to increase or decrease the divisor?

   (b) If we are using Adam's method to apportion the computers, will we need to adjust the divisor again, or are we done? If we are done, then what is the final apportionment? If we are not, will we need to increase or decrease the divisor?

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 there are 5 main courses on a menu and the main courses each come with a choice of three different side dishes chosen from the following options: bake potato, baked beans, green beans, corn, applesauce, house salad. How many dinners are possible?

13. Find the probability that if you flip a coin 5 times, you get exactly 3 heads. Hint: *Use Pascal's triangle.*

14. A box contains three red balls, two blue balls, and one green ball. A ball is drawn at random. A second ball is then drawn at random. The balls are not put back in the box.

(a) Show all the possible outcomes using a weighted 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.

15. Suppose that you flip an unfair coin that lands on heads 60% of the time. Make a weighted tree diagram for the possible outcomes of flipping the coin twice, and find the probability of each outcome. Make sure that you show the weights on each edge.

16. **Calculator Problem.** What is the middle entry in the 18th row of Pascals triangle? (Hint the middle entry is entry 9, if you start counting from zero).

17. Find the following without a calculator.

(a) ${}_6C_4$

(b) ${}_6P_3$

(c) ${}_{40}C_{38}$

18. The United States Senate currently has 55 Republicans, 44 Democrats, and 1 Independent. You may write your answer using the ${}_nC_k$ notation.

(a) How many different committees of 6 senators are possible?

(b) How many different 6-person committees with no Republicans are possible?

(c) If a committee of 6 senators were selected at random, how likely would it be for the committee to contain no Republicans?

19. **Calculator Problem.** 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?

20. 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	?

21. 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

22. Use the histogram below to find the average of the students' quiz scores.