Math 111 - Final Exam Review Problems

Here is material from the first half of the class. None of these problems need a calculator! Remember, you will not be allowed to use a calculator on the test.

1. We proved three famous theorems in our class: the Pythagorean theorem, the infinitude of primes, and the fact that $\sqrt{2}$ is irrational. Be sure that you know what irrational means, what a prime number is, and that you understand at least one of the proofs of the Pythagorean theorem.

2. What is 10% of 300 million? What is 50 thousand times 4 million in scientific notation?

3. Which of the following numbers is prime? What are the prime factorizations of each of these numbers?

   $$57 \quad 121 \quad 5795 \quad 349 \quad 764$$

4. It is a fact that $19 \times 26 = 494$. What does that mean about 494 mod 26? Use this information to help find 497 mod 26 without a calculator.

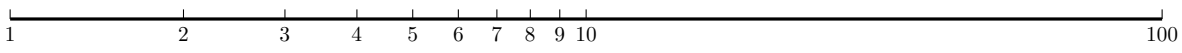
5. List 5 integers that are equivalent to -7 modulo 100.

6. Compute the following moduli (without a calculator)
   (a) 476 mod 3
   (b) 9979 mod 11
   (c) 4660 mod 9
   (d) 297 mod 10
   (e) 43 mod 2

7. If today is Friday, then what day of the week will it be 1403 days from now?

8. Find the following without a calculator.
   (a) $4,000 * (2.0 \times 10^5)$
   (b) 8% of 0.3
   (c) $(1,000)^7$
   (d) 6 thousand divided by 0.01.

9. Indicate where the numbers 24, 75, and $\frac{7}{3}$ belong on the logarithmic scale below.



10. Use factor-label method to write down an expression for how many seconds are in a decade.

11. If your investments grow by 50%, why isn't that the same as multiplying by 0.50? Explain.

12. Convert the following growth factors into percentage changes. Be sure to indicate if it is a percentage increase or decrease.
    (a) Quintuple
    (b) 1.35
    (c) 0.48
    (d) 2.6

13. Suppose that you put $1000 in a savings account that pays 3% 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.

14. Suppose that my (high risk) investment portfolio grows 100% one year, and then declines 40% the next year. Calculate the total percentage change in my investments (without a calculator).

15. Here is a preference schedule for an election with four candidates.

Class President Preferences					
Number of voters	**14**	**10**	**8**	**4**	**1**
1st choice	A	C	D	B	C
2nd choice	B	B	C	D	D
3rd choice	C	D	B	C	B
4th choice	D	A	A	A	A

    (a) Who will win the election above using the Plurality method?
    (b) Who will win the election above using the Borda count method?
    (c) Who will win the election about using Instant Runoff Voting?
    (d) Is there a Condorcet candidate? If so who is it?

16. What is strategic voting? Give an example of a three candidate election where some of the voters are likely to use strategic voting.

17. A law firm has 3 junior partners and one senior partner. A decision requires 3 people, unless the senior partner is involved, in which case it only takes 2. What is the Banzhaf power distribution in this law firm?

18. If I buy 4 sandwiches and 3 salads, then I have bought 7 things. Why is it ok to add 4 in 3 in this context, even though the multiplication rule says to multiply when you see numbers connected by the word "and"? When does the multiplication rule apply?

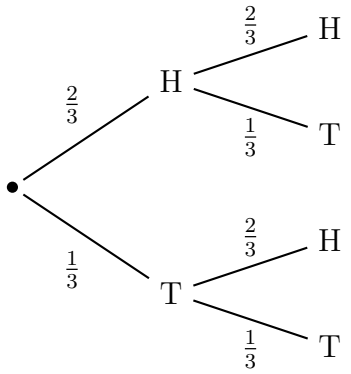
19. I want to select a group of representatives from a class to go to a conference. How many ways could I select a group of 3 students out of a class of 12?

20. Find the following without a calculator.
    (a) ${}_8C_6$

(b) ${}_8P_3$

(c) ${}_{100}P_2$

21. Use the weighted tree diagram below to find the probability of each outcome: HH, HT, TH, and TT.



22. If I flip a coin 6 times in a row, one event is that I get 5 or more heads. Describe the complimentary event in words.

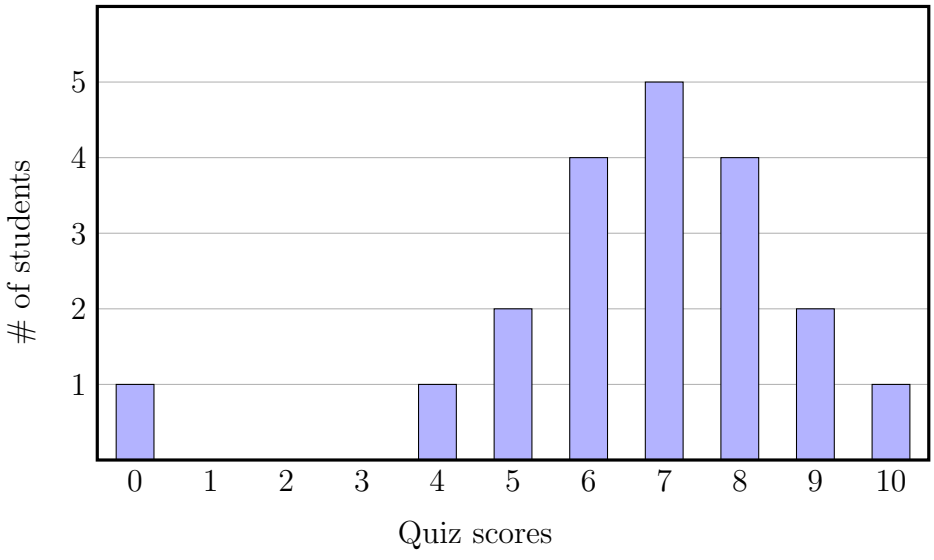
23. Find the expected value of a random variable with four possible outcomes and probabilities shown below.

Outcome	-1	0	4	10
Probability	0.1	0.25	0.25	?

24. 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

25. Use the histogram below to find the mean, median, and mode of the students' quiz scores.



26. A collection of data is distributed normally with mean $\mu = 76$ lbs. and standard deviation $\sigma = 5$ lbs. Find the z-values for the following data points.

    (a) 71 lbs.

    (b) 101 lbs.

27. What do you think a histogram would look like for each of the following situations? Would it look like a bell or would it look like some other curve? Make a plausible sketch of a histogram for each situation. Make sure your x-axis represents the outcomes for the situation described, and the height of the bars correspond to the number of times each outcome happens.

    (a) The number of times each student in a class has traveled outside of the United States.

    (b) Actual weights of unopened "12-ounce" bags of potato chips.

    (c) Number of heads if you flip a fair coin 400 times.

28. Suppose that 1 out 10 computers in an office typically need to be replaced in a given year. The office currently has 1600 computers. Accountants at the office know that more than 1 out of 10 computers might fail, but they can be 99.7% confident that the number of computers that will need to be replaced will be between what two numbers?