

## Problem Set 1

Due: Monday, January 27th

**Instructions:** Answer each of the following questions and provide a justification for your answer. In addition to the points assigned below, you will receive 0-2 writing points for the entire problem set. To receive full credit for the writing score, an answer should be readable as an English sentence and also give a clear explanation. You are allowed to use mathematical notation in a sentence but it should still read well. Here are a few sample answers and comments.

Sample Answer	Comments
$4+5+9=18$	This answer is not a complete English sentence and does not give any explanation.
There are $4+5+9=18$ ways to choose.	This is a complete English sentence but does not give an explanation.
Because we are choosing a single object from the entire collection, the number of ways to choose is the same as the number of objects. So, in this case, there are $4+5+9=18$ ways to choose.	This is an English sentence with a clear explanation.
There are $4+5+9=18$ objects, so there are 18 ways to choose just one.	This is an English sentence with a clear explanation.

- (2 points) Problem 1.1.1: There are six different French books, eight Russian books, and five different Spanish books on a shelf. a) How many different ways can you choose a book? b) How many ways can you choose one book of each language?
- (2 points) Problem 1.1.5: Just as we can discuss binary numbers, there also exist ternary numbers, consisting of 0's, 1's and 2's. a) How many 5-digit ternary numbers are there? b) How many 5-digit ternary numbers do not end in a zero? c) How many 5-digit ternary numbers begin with a 1?
- (2 points) Problem 1.1.6: What portion of 5-digit ternary numbers could also be interpreted as binary numbers? (In other words, what portion of 5-digit ternary numbers consist only of 0's and 1's)?
- (2 points) Problem 1.1.8: In a bag there are a green ball, a purple ball, a pink ball, and an orange ball. Without looking in the bag you choose a ball, record the color, and replace the ball in the bag. a) If you do this 4 times, how many different sequences of colors are possible? b) What if you don't replace the ball that you pick?
- (4 points) Problem 1.1.14: You find you need a companion and the Humane Society just happens to be on your way home from school. Stopping in, you find that they have 12 dogs, 17 cats, 8 weasels, and 5 guinea pigs. a) How many ways can you choose just one loving furball? b) Assuming you have a much larger apartment than the average student, how many ways can you choose one animal of each type? c) So your apartment's not that big—you decide you can take home two animals, but you want two different types. How many ways is this possible?

6. (2 points) Problem 1.2.9: In a student government election, you are asked to list 6 candidates in order of preference out of the 13 who are running. How many such orderings are there?
7. (4 points) Problem 1.2.5: I have 14 calculus textbooks on the shelf next to my desk. a) How many different ways can I arrange them? b) Four of these are “reform calculus” texts. How many ways can I arrange the books if I keep these four books together and the other ten books together? c) What if I keep these four books together but the other ten can come anywhere?