

**Show all work. Reduce all computations to a final number.
Credit cannot and will not be awarded for work not shown!**

1. (20 points) A collection of seven distinct coins will be arranged from left to right. There are four heads face up and three tails face up.



How many different ways can the coins be arranged from left to right?

How many different ways can the coins be arranged from left to right if there can be no consecutive heads?

How many different ways can the coins be arranged from left to right if the cent and the dollar are not consecutive?

How many different ways can the coins be arranged from left to right if the two eagles are adjacent?

2. (10 points) A collection of seven indistinguishable coins will be arranged from left to right. There are four heads face up and three tails face up.



How many different ways can the coins be arranged from left to right?

How many different ways can the coins be arranged from left to right if there can be no consecutive tails (the drummer)?

3. (10 points) A **radar** note is a paper bill whose serial number is palindromic. How many serial numbers on United States currency qualify as a radar note? Note that the serial number on modern US currency contains exactly 8 digits and leading zeroes are acceptable.



4. Susan buys an economy pack of sixty pens. The pens are identical except for color. There are ten of each of six different colors.
- (5 points) How many different ways can Susan select four pens of different colors to take to work?
 - (5 points) How many different ways can Susan select eight pens to take to work?
 - (10 points) How many different ways can Susan select thirteen pens from her economy pack to take to work? Describe your overall strategy for this problem first. Only then, should you compute the answer.

5. (10 points) Jason's CD collection consists of 6 different genres of music. Each genre contains 7 distinct CD's. Jason is planning a trip and randomly selects 4 CD's. How many different ways can this be done if Jason does not want to take more than 1 CD from any genre?

6. (10 points) Sylvia has ten pairs of distinct shoes. How many ways can Sylvia select

a. three distinct pairs of shoes;

b. five shoes yet have no matching pair?

7. (10 points) How many different arrangements exist of the letters in the element

a. *gold*;

b. *manganese*;

c. *phosphorus*?

8. (10 points) Four cards are selected from a deck of playing cards.

What is the probability that all four are clubs?

What is the probability that all four are Kings?

What is the probability that at least two cards are the same rank?

Bonus! (10 points) Prove $\frac{(3n+3)!}{6 * (3n)!}$ is an integer by canceling terms and reducing to polynomial form.