

MATH 111: Introduction to Probability. Permutations worksheet

The New York Yankees have a roster of twenty-five players with the following breakdown

- 10 pitchers,
- 6 outfielders,
- 7 infielders, and,
- 2 catchers.

The positions in baseball are

1. Ignoring positions, how many ways can the Yankees create a nine player batting order?
2. If pitchers cannot be in the line-up, how many batting orders can the Yankees have?
3. How many ways are there of assigning one player to first, one player to second, one player to third, and one player to shortstop? Only infielders can play these positions.
4. The manager, Joe Torre, has already picked the four infielders for the night, but has not assigned them their positions. How many ways can this be done? (Hint: How many ways can four unique objects be rearranged/permutated?)

Question 4 suggests that once the four infielders are picked, there are actually a few ways of rearranging them. So in question 3, the order that we pick them might not matter.

We'll say that two ways of selecting four infielders are *equivalent* if the four infielders in each selection are the same, but in a different order.

Another way to put it is that two ways of selecting four infielders are equivalent if one is a permutation of the other.

5. Joe Torre selects four infielders in order. How many other selections is this one equivalent to? (Hint: You've already answered this question.)

6. If order doesn't matter, then many of the ways of selecting four infielders are actually the same. How many ways are there of selecting four infielders if order doesn't matter? (Hint: Each selection can be grouped together with its equivalent selections. You've already counted how big the groups are and how many total selections there are. So how many groups are there?)

7. How many ways are there of choosing three outfielders and a catcher when order matters?

8. How many ways are there of choosing three outfielders, a catcher, and a pitcher when order doesn't matter?

9. How many ways are there of choosing three outfielders, four infielders, a catcher, and a pitcher when order doesn't matter?

10. How many ways are there of assigning all the positions? (That is, choosing all nine players when order matters).