For each of these exercises, first write out your calculations, using either the definition of permutations $P(n, k)$ or combinations $C(n, k)$. Then check your answer using the appropriate spreadsheet command; write down the spreadsheet command you use below.

1. (2 points) How many different ways are there to arrange the letters in the word “ABOVE”?

Solution:

$$P(5, 5) = 5 \times 4 \times 3 \times 2 \times 1 = 5! = 120$$

check using =permut(5,5)

2. (2 points) A club consisting of 15 members must select a president, vice-president and treasurer. In how many different ways can the positions be filled?

Solution:

$$P(15, 3) = 15 \times 14 \times 13 = 2,730$$

check using =permut(15,3)

3. (2 points) A track coach has 7 different runners on his team. He has to pick four of them to run a relay race, with one runner to run the 1st leg of the relay, another runner for the 2nd leg, and so on. How many different relay team orderings does the coach have to choose from?

Solution:

$$P(7, 4) = 7 \times 6 \times 5 \times 4 = 840$$

check using =permut(7,4)

4. (2 points) You have 2 tickets for a boat ride. But there are 6 people in your group of friends who want to go. How many different groups of friends could go?

Solution:

$$C(6, 2) = \frac{6 \times 5}{2} = \frac{30}{2} = 15$$

check using =combin(6,2)
5. (2 points) Luis is packing his bags for his vacation. He has 9 different stuffed animals, but he only has room in his bag for 5 of them. How many different groups of 5 stuffed animals are there?

\[
C(9, 5) = \frac{9!}{5!} = \frac{120}{120} = 126
\]

check using \( \text{combin}(9, 5) \)

6. (4 points) Consider a basketball team that has 15 players on its roster. The coach has to choose 5 players from the roster to play at any given time.

(a) How many different 5-player lineups does the coach have to choose from?

\[
\binom{15}{5} = C(15, 5) = \frac{15!}{5!} = \frac{360,360}{120} = 3,003
\]

check using \( \text{combin}(15, 5) \)

(b) Now suppose the 15 players consist of 3 centers, 6 forwards and 6 guards, and the coach must choose a lineup consisting of 1 center, 2 forwards and 2 guards. Now how many different lineups does the coach have to choose from?

\[
\binom{3}{1} \binom{6}{2} \binom{6}{2} = 3 \times 15 \times 15 = 3 \times 225 = 675
\]

since \( C(6, 2) = 15 \) (as computed in #4)

7. (2 points) Suppose restaurant has 12 different main dishes, 10 side dishes, and 6 different desserts. For a meal, you must choose one main dish, two different side dishes, and one dessert. How many different meals are possible?

\[
12 \times \binom{10}{2} \times 6 = 12 \times \frac{10 \times 9}{2} \times 6 = 12 \times 45 \times 6 = 3,240
\]