MAT2540, Classwork5, Spring2026

6.3 Permutations and Combinations

1. How many three letter "words" can be made from the letters a, b, and c with **no letters repeating**? A "word" is just an ordered group of letters. It doesn't have to be a real word in a dictionary.

2. Definition of Permutation and r-Permutation.

   A ______________ of a set of distinct objects is an ____________________ of these objects. Let A be a finite set with n elements. For ______________ , an ____________________ of A is an ordered selection of __________________________ from A.

3. Example.

   Let $S = \{1, 2, 3\}$. A 2-permutation of S: The **ordered** arrangement: _________________________________

   A permutation of S: The **ordered** arrangement: ____

4. The notation $P(r, n)$.

   Let n be a positive integer and r an integer with $1 \leq r \leq n$. The number of r-permutations of a set with n elements is denoted by $P(r, n)$:

   $P(r, n) =$____or ______________

   where factorial $n! =$____.

5. Example. $P(3, 5) =$

   $P(0, 7) =$

   We can extend the definition of $P(r, n)$ when ____________ if we use $P(r, n) = \frac{n!}{(n-r)!}$.

6. How many ways are there to select a first-prize winner, a second-prize winner, and a third-prize winner from 100 different people who have entered a contest?

7. How many permutations of the letters ABCDEFGH contain the string ABC ?

8. How many different committees of three students can be formed from a group of four students?

9. Definition of r-Combination.

Let n be a positive integer and r an integer with _______________. An _____________________ of elements of a finite set with n elements is an ______________________ selection of r elements from the set. Thus, an r-combination is simply a ____.

10. The notation $C(r, n)$.

Let n be a positive integer and r an integer with $0 \leq r \leq n$. The number of r-combinations of a set with n elements is called a binomial coefficient and is denoted by $C(r, n)$ or $\binom{n}{r}$:

$$C(r, n) = \_\_\_\_\_\_\_\_\_\_ \text{ or } \_\_\_\_\_\_\_\_\_\_$$

11. Let $S = \{1, 2, 3\}$. A 2- combination of S:

12. Binomial Coefficient, Pascal's Triangle, and Pascal's Identity.

n	Binomial Coefficient	Pascal's Triangle
0	$\binom{0}{0}$ =___	1
1	$\binom{1}{0}$ = ___, $\binom{1}{1}$ = _____	1 1
2	$\binom{2}{0}$ =___, $\binom{2}{1}$ =___, $\binom{2}{2}$ =___	1 2 1
3	$\binom{3}{0}$ =___, $\binom{3}{1}$ =___, $\binom{3}{2}$ =___, $\binom{3}{3}$ =___	1 3 3 1
4	$\binom{4}{0}$ =___, $\binom{4}{1}$ =___, $\binom{4}{2}$ =___, $\binom{4}{3}$ =___, $\binom{4}{4}$ =___	1 4 6 4 1
5	$\binom{5}{0}$ =___, $\binom{5}{1}$ =___, $\binom{5}{2}$ =___, $\binom{5}{3}$ =___, $\binom{5}{4}$ =___, $\binom{5}{5}$ =___	1 5 10 10 5 1

Pascal's Identity:______________________ For example, ____________________________

13. Observation: ____

Let n and r be nonnegative integers with $r \leq n$. Then ____________________________.

14. How many poker hands of five cards can be dealt from a standard deck of 52 cards? Also, how many ways are there to select 47 cards from a standard deck of 52 cards?

15. Suppose that there are 9 faculty members in the mathematics department and 11 in the computer science department. How many ways are there to select a committee to develop a discrete mathematics course at a school if the committee is to consist of three faculty members from the mathematics department and four from the computer science department?