

12.2 Permutations and Combinations

1. Solve problems involving linear and circular permutations.
2. Solve problems involving combinations.

Permutation: when a group of objects are arranged in a certain order. The order does matter...

Linear permutation: the arrangement of objects or people in a line.

Circular Permutations: the arrangement of objects or people in a circle.

PERMUTATIONS

The number of permutations of n distinct objects taken r at a time is:

$$P(n,r) = \frac{n!}{(n-r)!}$$

n is # of total things
 r is how many you are choosing

There are 10 finalists in a competition. How many ways can a gold, silver and bronze be awarded?

$n =$

$r =$

Linear Permutations

- How many ways can the letters in the word *ocean* be arranged?

$n!$ is used for linear permutations

Linear Repetitions

How many ways can the letters in the word **MISSISSIPPI** be rearranged?

Since there are letters (I, S, P) that repeat, they must be accounted for in the formula.

$$\frac{n!}{(r!q!)}$$

n is the # of total letters

r and q represent letters that repeat.

Circular Permutations

When n objects are arranged in a circle the formula is: $(n-1)!$

1) How many ways can 8 people be seated at a round table?

Fixed Starting Point

2) How many ways can 8 people be seated at a round table if Bill sits at the head of the table? (it is linear as the people are lined up according to a beginning point, Bill)

Circular Reflections

How many ways can 6 keys on a keychain be arranged?

Since the keychain can be looked at from two ways, it is a reflection and you must divide by 2...

Bracelet/necklace problems

clasp: linear problem = $n!/2$

no clasp: circular = $(n-1)!/2$

1) How many ways can 5 charms on a bracelet be arranged that has no clasp?

2) How many ways can 5 charms on a bracelet be arranged that has a clasp?

“Identical” problems

How many ways can 2 identical pens and 7 identical watches be given to 9 graduates if each one receives a gift?

Since the watches are all identical they are set as 7!

Since the pens are identical they are set as 2!

The total is 9 so it is set as 9!

$$\frac{9!}{2!7!}$$

Combinations

The arrangement or selection of objects in which the order is not important. The number of combinations of n objects taken r at a time is written as $C(n,r)$.

$$C(n,r) = \frac{n!}{(n-r)! r!}$$

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A group of seven students working on a project needs to choose two from the group to present a report to the class. How many ways can they choose the two students?

Since the order is not important it is a combination problem.

$$C(7, 2) =$$

Playing Card info

Deck consists of 52 cards of 4 different suits
(hearts, clubs, diamonds, spades)

Each suit has 13 cards in it.

Multiple Events (be careful) P. 640

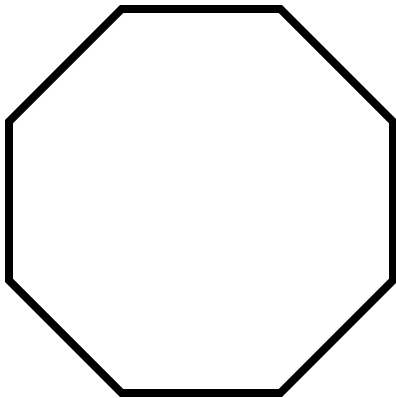
Five cards are drawn from a standard deck of cards. How many hands consist of 3 clubs and 2 diamonds?

Multiply the number of ways to select the clubs and the number of ways to select a diamonds.

$$\begin{aligned} \text{clubs} &= C(13, 3) & \text{clubs} \cdot \text{diamonds} \\ \text{diamonds} &= C(13, 2) \end{aligned}$$

Diagonals of a Figure

How many diagonals can be made from an 8-sided figure?



$$C(n,r) - n$$

$n =$

$r =$

HOMework

- P. 641 # 12-34 all, 41-45