2.3 - Permutations with Restrictions

August 29, 2019 1:41 PM

FOUNDATIONS OF MATH 12 Ch. 2 – Day 3: Permutations with Restrictions

In some problems, some of your choices will be forced or restricted in some way.

For example, how many ways can the word "orange" be rearranged if there are no restrictions, and then, if the first letter must be "n"?

no restrictions

$6! = {}_6P_6$

$= 720$

# of choices: n ? ? ? ? ?

1 × 5 × 4 × 3 × 2 × 1

$5! = {}_5P_5 = 120$

Example

Three girls and four boys are to be arranged in a row for a picture. How many ways can the people be arranged if there are no restrictions? How many ways can they be arranged if no boys and no girls sit next to one another?

no restrictions

$7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

$7! = {}_7P_7 = 5040$ ways

no adjacents:

note for Mcson:

Only possible if boys begin and end the line.

ie.

# of choices:

B_1 G_1 B_2 G_2 B_3 G_3 B_4

4 3 3 2 2 1 1

For Boys: 4!

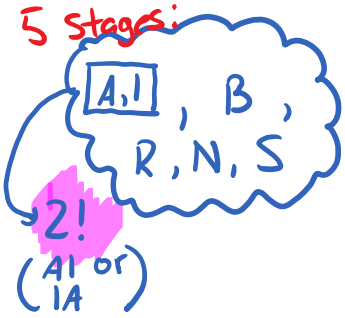
For Girls: 3!

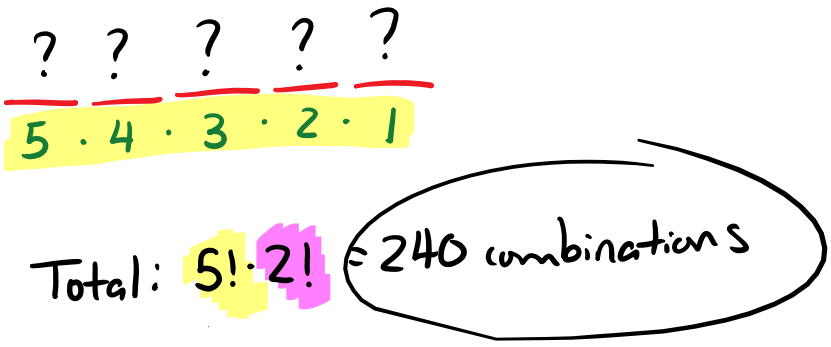
Total: 4!3! = 144 possibilities.

Example

How many combinations of letters can the word "brains" be rearranged if the vowels must be kept together?

Vowels: A, I

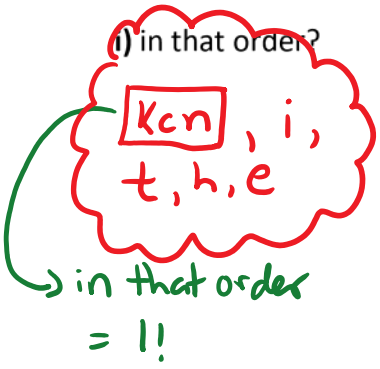


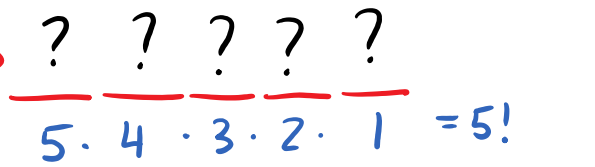


Example

How many permutations of the letters in the word "kitchen" can be made if the letters "k," "c," and "n," must be kept together

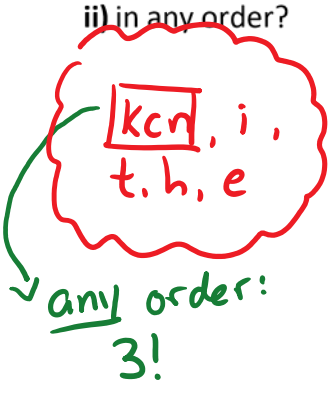
i) in that order?

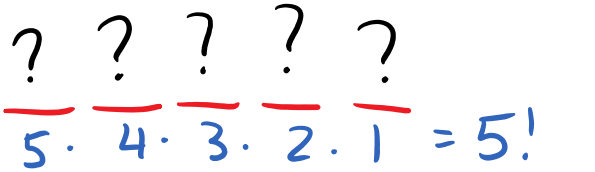




Total: $5!1! = 120$ possibilities.
$_5P_5 \; _1P_1$

ii) in any order?





Total: $5!3! = 720$ possibilities.
$_5P_5 \; _3P_3$