

4.3 PermutationsWithIdenticalElements.notebook

4.3 Permutations with Identical Elements

Sometimes permutations will occur where some items are **identical**. In other words, you cannot tell them apart.

The number of permutations of a set of n objects containing:

a identical objects of one kind;

b identical objects of another kind;

c identical objects of a third kind.

$$\frac{n!}{a! b! c!}$$

and so on, if there are more identical objects.

Example 1: How many distinct permutations of the letters of the word OTTAWA?

Example 2: How many distinct permutations of the letters of the word OTTAWA are there that begin and end with the letter T?

Example 3:

- a) A stuffed animal game machine has 15 identical monkeys, 10 identical bears, and 6 identical elephants. If you are guaranteed a prize for every game and you play the game until the machine is empty, how many arrangements of prizes could you win?

- b) If the question is reworded to become "a stuffed animal game machine has 15 distinct monkeys, 10 distinct bears, and 6 distinct elephants and if you are guaranteed a prize for every game and you play the game until the machine is empty, how many arrangements of prizes could you win?"

Ex:

- (a) How many distinct seven digit numbers can be constructed from the digits 1, 2, 2, 3, 3, 4, 5 ?

- (b) How many of these would be *odd numbers*?

- (c) How many of these would be less than 3,000,000?

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Ex:

In how many ways can 6 friends line up for movie tickets if Brad must always be ahead of Sam and nobody can distinguish between the Simpson twins?

Ex:

In how many ways can 9 friends line up for a photograph if James and Lee must stand next each other, and Harpreet and Fatima must not stand next to each other?