Warm Up 1/26/23

1. What is this called?
2. Does the order of the numbers matter?

21.2-21.3 Combinations and Permutations

Permutation: an arrangement of a group of objects in which order matters 1324 is different from 4132

Think of 4 people lining up in a line

(the lock should really be called a permutation lock)

Combination: an arrangement of a group of objects in which order doesn't matter 1324 is the same as 4132

Think of 4 people being in room

A permutation is an ordered combination

Permutations with repetition (objects can repeat):

For the lock above there are:

$\underline{10} \times \underline{10} \times \underline{10} \times \underline{10} = 10^4$ or 10,000 permutations

(we used ten since there are 10 numbers from 0-9)

Permutations without repetition (objects can't repeat):

For the lock above there are:

$$\underline{10} \times \underline{9} \times \underline{8} \times \underline{7} = 5040$$

After the first number is used, it can't be used again.

$$_{10}P_4 = \frac{10!}{(10-4)!} = \frac{10\times9\times8\times7\times6\times5\times4\times3\times2\times1}{6\times5\times4\times3\times2\times1} = 5040$$

The number of permutations of 10 objects taken 4 at a time.

The number of permutations of n objects taken r at a time

$$_nP_r = \frac{n!}{(n-r)!}$$ (can be written as $P(n,r)$)

The numbers 0-9 are distinct objects. What if the objects are not distinct like the letters in the word **even**?

Some permutations are: **e**ven **e**evn n**e**ev ev**e**n

The 1st and the 4th are the same so we don't want to count it twice. (divide out the repeated letters)

$$\frac{4!}{2!} = 12$$

For n objects where one object repeats a times, a second object repeats b times and so on is: $\frac{n!}{a!\times b!\times \ldots}$

How many ways can the letters in INDEPENDENT be arranged?