Lecture 2: Worksheet

In this worksheet, we look at some combinatorial formulas for 4 important combinatorial tools:

- **Permutations** In how many ways can we permute n objects Example: There are 6 ways to permute ABC.

- **Combinations** How many words of length k in an alphabet of n elements are there: Example: there are 9 words of length 3 with the letters MA

- **Selection with order** How many ways can we select k elements from n elements if the order does not matter. Example: there are 6 ways to select a set of 2 elements from 4.

- **Selection without order** In how many ways can we select k elements from n elements if the order does matter. Example: there are $4*3 = 12$ ways to select 2 ordered pairs from 4

How many ways are there to:	The answer is:
permute n different elements	$n! = n(n-1)...2 \cdot 1$
write word of length k in alphabet of n letters	n^k
pick k different from n if order matters	$\frac{n!}{(n-k)!}$
pick k different from n without looking at order	$\binom{n}{k} = \frac{n!}{k!(n-k)!}$

1 **Problem 1)** You play "scrabble" and have the letters

$$1, 9, A, M, T, B, H .$$

What is the probability to obtain the word $MATH19B$?

2 **Problem 2)** You randomly type 6 letters on your computer using the alphabet $A - Z$. What is the probability that the text will show

$$HARVARD .$$

3 **Problem 3:** If we pick 2 letters from the group of letters

$$LINEAR .$$

What is the chance to get the two letters AR?

4 **Problem 4:** A combination lock has 40 numbers $0 - 39$. A lock combination consists of 3 different numbers, where the order matters. You try 10 times. What is the probability that you pick the lock?