# Lab: Combinatorial Algorithms

This document defines the **in-class exercises** (lab) for the ["Algortihms" course @ Software University](https://softuni.bg/trainings/1194/Algorithms-September-2015).

# Part I – Permutations

## Permutations without Repetitions

Given a set of elements, find all permutations without repetitions.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| A B C | A B C  A C B  B A C  B C A  C B A  C A B |

## Permutations without Repetitions

Given a set of elements, find all permutations without repetitions.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| A B C | A B C  A C B  B A C  B C A  C A B  C B A |

## Permutations with Repetitions

Given a multi-set of elements, find all permutations.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| A B B | A B B  B A B  B B A |

# Part II - Variations

## Variations without Repetitions

Given a set of elements, find all variations of k elements without repetitions.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| A B C  2 | A B  A C  B A  B C  C A  C B |

## Variations with Repetition

Given a set of elements, find all variations of k elements with repetitions.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| A B C  2 | A A  A B  A C  B A  B B  B C  C A  C B  C C |

# Part III - Combinations

## Combinations without Repetition

Given a set of elements, generate all combinations of k elements without repetition.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| A B C  2 | A B  A C  B C |

## Combinations with Repetition

Given a set of elements, generate all combinations of k elements with repetition.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| A B C  2 | A A  A B  A C  B B  B C  C C |

# Part IV - Binomial Coefficients

## N Choose K Count

Given a **n** and **k**, calculate the number of possible **n choose k** combinations (without repetition).

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3  2 | 3 |
| 49  6 | 13983816 |