# Project 1 (10%)

## Problem domain: Production of Pascal’s Triangle

The objective of this project is to enable you to apply the concept of abstraction to problem solving. You are required to do the following tasks:

1. Devise a set of algorithms for the given problem domain and represent them using the Algorithmic Definition Language (ADL).
2. Implement the algorithms you devised in (1) systematically in either C# or Java as a console application and test your implementation.
3. A video presentation that showcases the capabilities of software in (2).
4. A descriptive report on any aspect of design and development, including artefacts produced for the project.
5. Produce a short report outlining response to formative feedback.
6. Add your solutions to your portfolio using the portfolio template provided.

This project represents 10% of the total marks available in this module.

**Note that the deadline for completion of this project is the same as the submission date of your portfolio. However, you are advised to complete it by 18th October 2021 (i.e., Week 13) to avoid increasing your workload as other projects will be given out throughout the semester.**

## Binomial coefficients

"In mathematics, *binomial coefficients* are a family of positive integers that occur as coefficients in the binomial theorem."[[1]](#footnote-2)

The quantities n! / k! (n-k)! are the famous *binomial coefficients*, and they are denoted by[[2]](#footnote-3)



Some of their special values are

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It is convenient to define Description: C:\Users\cmsmo\AppData\Local\Temp\CodeCogsEqn-1.gifto be zero if k < 0 or if k > n.

## Pascal's Triangle

In the following table, we show the values of some of the binomial coefficients Description: C:\Users\cmsmo\AppData\Local\Temp\CodeCogsEqn-1.gif. The rows of the table are thought of as labelled 'n = 0', n = 1', etc, and the entries within each row refer, successively, to k = 0, 1, 2, …. n. The table is called 'Pascal's triangle'.

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

1 8 28 56 70 56 28 8 1

Here are some facts about the binomial coefficients:

1. Each row of Pascal's triangle is symmetric about the middle. That is,

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1. The sum of the entries in the nth row of Pascal's triangle is 2n.
2. Each entry is equal to the sum of the two entries that are immediately above it in the triangle.

## Grading Criteria

This project will be graded using the criteria given below.

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| An assessment of understanding and use of algorithmic notation | 25 |
| An assessment of understanding of algorithm design | 40 |
| An assessment of overall software, including testing | 30 |
| Incorporation of formative feedback | 5 |

1. [Wikipedia](http://en.wikipedia.org/wiki/Binomial_coefficient) (<http://en.wikipedia.org/wiki/Binomial_coefficient>) [↑](#footnote-ref-2)
2. "Algorithms and Complexity", Herbert S. Wilf, Prentice-Hall, 1986, ISBN: 0-13-022054-X. [↑](#footnote-ref-3)