

# Computer Science 720 S1 – (2025)

## Assignment 1 (part 1)

### Requirements

For this part of Assignment 1 we want to see if you can extend the ideas for enumerating and ranking efficiently a basic type of combinatorial objects.

Consider binary strings  $B2_n$  of length  $n$  where there are no contiguous subsequence of length longer than two. Consider lexicographic ordering of  $B2_n$ . For example:

$$B2_4 = \{0010, 0011, 0100, 0101, 0110, 1001, 1010, 1011, 1100, 1101\}$$

Write programs for the following problems, where the size constraints of  $x \in B2_n$  are limited to  $1 \leq n \leq 1000$ .

count: Given an integer  $n$ , output  $|B2_n|$ .

successor: Given a string  $x$  of  $B2_n$  print the successor of  $x$ , or 'None' if  $x$  is the last one in the lexicographic enumeration.

rank: Given a string  $x$  of  $B2_n$  print the rank of  $x$  in the lex order. Remember the first element of  $B2_n$ , namely 00100100100..., has rank of 0.

There will be easy and hard test cases available to solve for each problem. Input, taken from keyboard/stdin, will be several instances consisting of several lines of test strings  $x \in B2_n$ . The first line of each test file will be an integer  $1 \leq m \leq 10000$  denoting the number of tests in that file. This is followed by  $m$  tests, each on its own line.

### Submission and Marks

Due: Saturday, April 12 (11.59pm).

All solutions should be submitted to <http://www.cs.auckland.ac.nz/automated-marker>

Your single-source-file programs should use one of the valid programming language extension allowed. Please read the automarker help/FAQ page. Develop and program your own solutions (e.g. don't search the Internet or share code with fellow classmates). You are allowed to submit up to 8 times before a 20% penalty per task is applied.

This assignment is worth half 10% of your final grade. Note the second part of the assignment will be worth 15% and also due the same day so try to complete this part as early as possible..