

Chapter-01 Mathematics for Competitive Coding

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Welcome to the Course !

Course Logistics -

- 1) Live Sessions + Videos on LMS | Coding Blocks Online
- 2) HackerBlocks - Contests
- 3) Resources and Notes, Doubts on Slack
- 4) Book at the end of the course

WARM UP **- BIRTHDAY PARADOX !**

What is the minimum number of people that should be present in a room so that there's 50% chance of two people having same birthday ?

In a room of just __ people there's a 50-50 chance of two people having the same birthday. In a room of __ there's a 99.9% chance of two people matching.

HINT:

If there are two people in a room, Probability that two will have same birthday = $1/365 = 0.00274 = 0.274\%$

Probability that two will have different birthdays = $1 - (\text{probability that two have same birthday}) = 1 - 0.00274 = 0.9973 = 99.73\%$

SOLUTION:

23 for 50% probability

70 for 99.9% probability

CODE: <http://cb.lk/code/BDAYP>

TYPES OF PROBLEMS IN MATHEMATICS

- **Adhoc/Formula Based/Brute Force**
- **Big Integers**
- **Exponentiation**
- **Number Systems/Series**
- **Pigeonhole Principle**
- **Inclusion-Exclusion Principle**
- **Probability & Expectation**
- **Combinatorics**

ADHOC/BRUTE FORCE

These are relatively simpler problems based upon some formula or complete search.

Lotto (HackerBlocks)

In the German Lotto you have to select 6 numbers from the set $\{1, 2, \dots, 49\}$. A popular strategy to

play Lotto - although it doesn't increase your chance of winning — is to select a subset S containing k ($k > 6$) of these 49 numbers, and then play several games with choosing numbers only from S .

For example, for $k = 8$ and $S = \{1; 2; 3; 5; 8; 13; 21; 34\}$ there are 28 possible games:

[1,2,3,5,8,13],

[1,2,3,5,8,21], [1,2,3,5,8,34], [1,2,3,5,13,21], ..., [3,5,8,13,21,34].

Your job is to write a program that reads in the number k and the set S and then prints all possible games choosing numbers only from S .

Code !!!

BIG INTEGERS

In Java, Python it is easy to work with big integers but in C++ it's difficult because the **long long int** datatype can store only at max 18 digits.

So, for problems involving Big Numbers(containing 100's of digits) we either use **Java Big Integer Class** or Python or we use **Arrays in C++** ! Let us see one example.

Note : There is a BOOST C++ Library which allows us to work with big integers as well.

Computing Large Factorials in C++ !

The Java Big Integer Class !

In Java, the Big Integer class is very powerful and supports lots of operations on big numbers (having 100's of digits) like -

- 1) Modular Arithmetic
- 2) Base Conversion
- 3) GCD Calculation
- 4) Power Calculation
- 5) Prime Generation
- 6) Bit-masking, Bitwise Operations
- 7) Other Miscellaneous Tasks

It is important to learn about this class, to make our work easy in Programming Contests

Examples -

Example-1 Factorial of Big Number

C++ Code : <http://cb.lk/code/CFACT>

Java Code : <http://cb.lk/code/JFACT>

Python Code : <http://cb.lk/code/PFACT>

Example-2 Julka - Spoj

Problem - <http://www.spoj.com/problems/JULKA/>

Solution - <http://cb.lk/code/JULKA>