Combinations and Permutations

Pigeonhole principle states that if n items are put into m containers, with $n > m$, then at least one container must contain more than one item

Pigeonhole principle
Dirichlet's box principle
Dirichlet's drawer principle
Originated in Year 1624
Further enhanced in Year 1834 by Dirichlet

Exercise 1:

In a square, side length is 1. If we put in 5 dots in the square, please prove that at least the distance of two points would be smaller than √2/2.

Exercise 2:
For any random given 11 whole numbers, there must be
two numbers, the difference of the these two numbers is 10’s multiple.

Exercise 3:
In a road 100 meters long, if we plan 102 trees,
there must be 2 trees whose distance is smaller than 1 meter.

Exercise 4

A middle school has 11,000 students. Please prove there must be 4 students who were born in the same day, i.e. same year, month, and day.

Pigeonhole principle:

- **Simple and easy to understand**
- **Can be used to solve many hard and interesting problem**
  - **Identify Sets and Elements/objects**
  - **Make sure the sets and objects are in line with the problem to be solved**
  - **Prove using Pigeonhole principle**