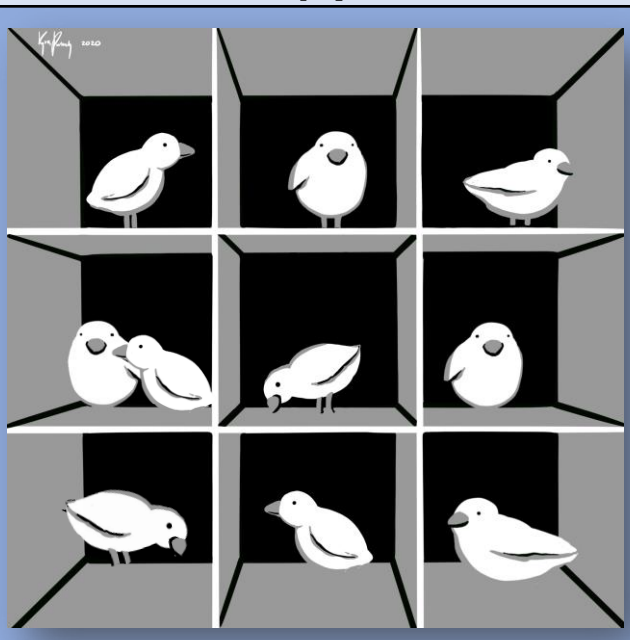
PIGEONHOLE THEORY

What is the Pigeonhole Principle?

If n pigeons (or any other object) are placed in m holes and n > m, at least one hole must contain more than one pigeon. If there are more holes than pigeons (n< m), some of the holes are empty.

History of the Pigeonhole Theorem:

It is thought that **Dirichlet**, made the first formalization of the pigeonhole concept and he used to call the concept the **"drawer/shelf principle."** As Dirichlet published works in both **French** and **German**, he alternately referred to the fundamental idea as **Schubfach** or **Tiroir**, both of which **mean drawer**. The type of drawer Dirichlet was referring to, though, is thought to have been best translated into English as a **pigeon-hole** since his father was a postmaster and they are frequently used for sorting and storing mail. Mathematician **Raphael M. Robinson** gave the name **"pigeonhole principle"** for the first time in **1940.**



Application:

The Pigeonhole principle can be applied to many ideas and concepts. For example, when you compare **strands of hair** across a large location, like London, the pigeonhole principle says that **at least two people** have the same number of strands of hair!

$$\frac{\sum_{i=1}^{n} a_i}{n} = t \implies \sum_{i=1}^{n} a_i = nt.$$

Try Yourself:

1.There are **50 baskets of mangoes**. **Each basket** contains no more than **24 mangoes**. Show that there are at least **3 baskets** containing the **same number of mangoes**.

2.If David has an **infinite number** of **red**, **blue**, **yellow**, and **black socks** in a drawer, what is the minimum number of socks that he must pull out of the drawer to guarantee **a pair**?

Reference 1: Pigeonhole principle: Definition, Differences, Applications (testbook.com)

Reference 2: Pigeonhole Principle | Brilliant Math & Science Wiki

Reference 3: Pigeonhole Principle: Theorem, Statement & Examples (geeksforgeeks.org)

Reference 4: Pigeonhole principle - HandWiki

Reference 5: proofs - Examples and applications of the pigeonhole principle - Mathematics Educators Stack Exchange

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By Student 1 and Student 2

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Managed by Swansea University, Wales Institute of Mathematical and Computational Sciences

Ariennir gan Lywodraeth Cymru
Funded by Welsh Government