# Week 3 Discrete Math Notes

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## Pigeonhole Principle

### Simple Form

If $n + 1$ objects are distributed into $n$ boxes, then at least one box contains two or more of the objects.

### Stronger Form

Let $q_1, q_2, \ldots, q_n$ be positive integers. If

$$(q_1 + q_2 + \cdots + q_n) - n + 1$$

Objects are distributed into $n$ boxes, then either the first box contains at least $q_1$ objects, or the second box contains at least $q_2$ boxes, $\ldots$, or the $n$th box contains at least $q_n$ objects.

There is special case, where $q_1, q_2, \ldots, q_n$ are all equal to come integer $r$, this is called the corollary and it is where the simple form is derived from.

**Corollary**:

Let $n$ and $r$ be positive integers. If $n(r-1)+1$ objects are distributed into $n$ boxes, then at least one of the boxes contains $r$ or more objects.