COMP1215 - Combinatorics

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1 Inclusion and Exclusion

1. $|A \cup B| = |A| + |B| - |A \cap B|$

2 Pigeonhole principle

If $|A| > |B|$ (size of A $>$ size of B), then every function from A to B maps at least 2 distinct elements of A to the same element of B.
In other words:

$$\text{For } f : A \to B \; \exists x_1, x_2 \in A, x_1 \neq x_2 \text{ such that } f(x_1) = f(x_2)$$

Example 2.1.

$$A = \{x \mid x \in \mathbb{Z} \; and \; |x| \leq 5\}$$

$$B = \{x \mid x \in \mathbb{N} \; and \; x \leq 5\}$$

As you can see, $|A| < |B|$, so all valid functions between A and B must map at least one pair of x values to the same y value.

$$f : A \to B$$

$$f(x) = x^2$$

$$f(-5) = 25$$

$$f(5) = 25$$