Definition (Properties of a relation). Let $R \subseteq \mathbf{A} \times \mathbf{B}$ be a relation. R is:

1. *Surjective* if for all $y \in \mathbf{B}$ there exists an $x \in \mathbf{A}$: xRy;
2. *Injective* if for all $x_1 R y_1,\ x_2 R y_2$:

$$\frac{y_1 = y_2}{x_1 = x_2}$$

3. *Everywhere-defined* if for all $x \in \mathbf{A}$ there exists an $y \in \mathbf{B}$: xRy;
4. *Single-valued* if for all $x_1 R y_1,\ x_2 R y_2$:

$$\frac{x_1 = x_2}{y_1 = y_2}$$