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

1. *Surjective* if for all $y \in \mathbf{B}$ there exists an $x \in \mathbf{A}$ such that $\langle x, y \rangle \in \mathbf{R}$;
2. *Injective* if for all $\langle x_1, y_1 \rangle, \langle x_2, y_2 \rangle \in \mathbf{R}$ it holds: $y_2 = y_2 \Rightarrow x_1 = x_2$;
3. *Defined-everywhere* if for all $x \in \mathbf{A}$ there exists an $y \in \mathbf{B} : \langle x, y \rangle \in \mathbf{R}$;
4. *Single-valued* if $\forall \langle x, y_1 \rangle, \langle x_2, y_2 \rangle \in \mathbf{R}$ it holds: $x_1 = x_2 \Rightarrow y_1 = y_2$.