1. Complete the following definitions:

Let $R$ be a relation defined on a set $A$. We call $R$ reflexive provided $\forall x \in A, x \mathrel{R} x$.

Let $R$ be a relation defined on a set $A$. We call $R$ symmetric provided $\forall x, y \in A, x \mathrel{R} y \Rightarrow y \mathrel{R} x$.

2. Let $A = \{a, b, c, d\}$ and let $R = \{(a, a), (b, b), (c, c), (d, d), (a, b), (b, d)\}$.
   (a) Draw the digraph of $R$.

   (b) Is $R$ transitive? Justify your answer.

   No, $a \mathrel{R} b$ and $b \mathrel{R} c$ but $a \not\mathrel{R} c$.
3. Let $A = \{1, 2, 3\}$ and let $R = \{(1, 1), (1, 2), (2, 1), (3, 3)\}$. Determine if $R$

is reflexive, irreflexive, symmetric, antisymmetric and/or transitive.

- A is not reflexive because $2 \notin R$.
- A is not irreflexive because $3 \in R$ (also $1 \in R$).
- A is symmetric.
- A is not antisymmetric: $1 \in R$ and $2 \in R$ but $1 \neq 2$.
- A is not transitive because $2 \in R$ and $1 \in R$ but $2 \notin R$.

4. Let $A = \{1, 2, 3, 4\}$ and let $R = \{(1, 2), (2, 1), (1, 3), (4, 4)\}$. Explain why

$R$ is not symmetric.

- A is not symmetric because $1 \in R$ but $3 \not\in R$. 