# Discrete Mathematics — Tutorial Sheet 05 — Relations

BSc (H) in App Comp, BSc (H) in Comp Foren

## Into/Onto and One-to-One

See questions in notes.

**Question 1**

For each of the following relations $R$ defined on set $A = \{1, 2, 3, \ldots\}$, determine which of the given ordered pairs belong to $R$

**(a)** $(x, y) \in R$ iff $x|y$; (2, 3), (2, 4), (2, 8), (2, 17)

**(b)** $(x, y) \in R$ iff $x \leq y$; (2, 3), (3, 2), (2, 4), (5, 8)

**(c)** $(x, y) \in R$ iff $y = x^2$; (1,1), (2, 3), (2, 4), (2, 6)

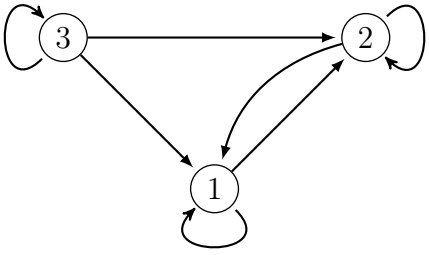
## Properties of Relation on a Set

**Question 2**

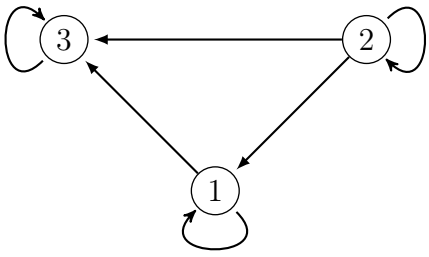
Consider the relations represented in the following graphs.

- Determine whether the given relations are reflexive, symmetric, antisymmetric, or transitive.
- Determine which relations are asymmetric, irreflexive.
- Which of the graphs are of equivalence relations?
- Construct the transitive closure of each relation.

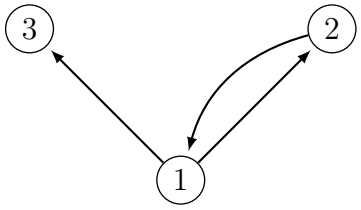
**(a)**



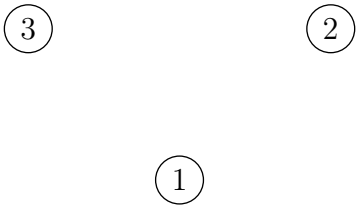

**(b)**



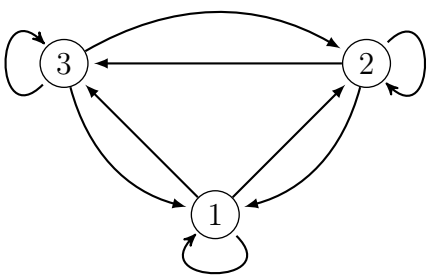

**(c)**



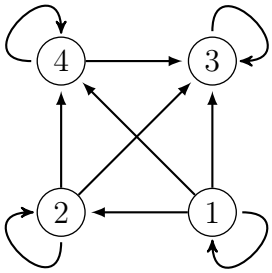

**(d)**




**(e)**




**(f)**



**Question 3**

Consider the relation on $\{1, 2, 3, 4, 5, 6\}$ defined by $R = \{(i, j) :| \ i - j \ |= 2\}$.

**(a)** Is $R$ reflexive?

**(b)** Is $R$ symmetric?

**(c)** Is $R$ transitive?

**(d)** Draw a digraph of $R$.

**Question 4**

Determine which of the following are equivalence relations for the given sets:

**(a)** $A = \{\text{lines in the plane}\}$, and $R$ defined by $(x, y) \in R$ if and only if $x$ is parallel to $y$.

**(b)** $A = \mathbb{R}$ and relation $R$ defined by $(x, y) \in R$ if and only if $|x - y| \leq 7$.