Background

Having collections of data: Good.

Knowing the connections between collections: Better!

Example(s):
Relations (1 / 2)

**Definition:** (Binary) Relation

Example(s):

Relations (2 / 2)

**Definition:** Related

Example(s):
Example #1: Presidents–Parties

Recall: \( A = \{ \text{Kennedy, Johnson, Nixon, Carter, Reagan} \} \)
\( B = \{ \text{Dem, Rep} \} \)
\( R = \{(\text{Kennedy, Dem}), (\text{Johnson, Dem}), (\text{Nixon, Rep}), (\text{Carter, Dem}), (\text{Reagan, Rep}) \} \)

Kennedy

Johnson

Nixon

Carter

Reagan

Democratic Republican

Example #2: \( x \% y = 0, x \neq y \)

Recall: \( H = \{ 1, 2, 3, 4, 5, 6 \} \)
\( R = \{(2, 1), (3, 1), (4, 1), (5, 1), (6, 1), (4, 2), (6, 2), (6, 3) \} \)
Properties of Relations: Reflexivity

**Definition:** Reflexivity

Example(s):

Properties of Relations: Symmetry (1 / 2)

**Definition:** Symmetry

Example(s):
Properties of Relations: Symmetry (2 / 2)

Example(s): Graph Representations & Symmetry

Properties of Relations: Antisymmetry (1 / 2)

Definition: Antisymmetry

Example(s):
Properties of Relations: Antisymmetry (2 / 2)

Example(s): Graph Representations & Antisymmetry

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Properties of Relations: Transitivity (1 / 2)

Definition: Transitivity

Example(s):
Properties of Relations: Transitivity (2 / 2)

Example(s):

Relational Composition Examples (1 / 4)

Three examples of creating relations from relations.

Example #1: Set Operators
Example #2: Swapping content of ordered pairs

**Definition: Inverse**

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Example #3: Composites

**Definition: Composite**

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Example(s):
Example #3: Composites (cont.)

Example(s):

Definition: Complement

Equivalence Relations (1 / 4)

You may have already implemented one in Java...

Definition: Equivalence Relation
Example(s):

So . . . why are these called \textit{equivalence} relations?

Recall:

$$R = \{ (0, 0),$$
$$\quad (1, 1), (1, -1), (-1, 1), (-1, -1),$$
$$\quad (2, 2), (2, -2), (-2, 2), (-2, -2) \}$$
Equivalence Relations (4 / 4)

**Definition: Equivalence Class**

**Example(s):**

Partial Orders (1 / 3)

Consider scheduling the construction of a house.

**Definition: Reflexive (a.k.a. Weak) Partial Order**
Partial Orders (2 / 3)

Example(s):

Partial Orders (3 / 3)

Definition: Irreflexivity (of Relations)

Definition: Irreflexive (a.k.a. Strict) Partial Order
Total Orders (1 / 2)

Definition: Comparable

Definition: Total Order

Total Orders (2 / 2)

Example(s):