

Relations and Their Properties

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CS/APMA 202

Aaron Bloomfield

What is a relation

- Let A and B be sets. A binary relation R is a subset of $A \times B$
- Example
 - Let A be the students in a the CS major
 - $A = \{\text{Alice, Bob, Claire, Dan}\}$
 - Let B be the courses the department offers
 - $B = \{\text{CS101, CS201, CS202}\}$
 - We specify relation $R = A \times B$ as the set that lists all students $a \in A$ enrolled in class $b \in B$
 - $R = \{ (\text{Alice, CS101}), (\text{Bob, CS201}), (\text{Bob, CS202}), (\text{Dan, CS201}), (\text{Dan, CS202}) \}$

More relation examples

• Another relation example:

- Let A be the cities in the US
- Let B be the states in the US
- We define R to mean a is a city in state b
- Thus, the following are in our relation:
 - (C'ville, VA)
 - (Philadelphia, PA)
 - (Portland, MA)
 - (Portland, OR)
 - etc...

• Most relations we will see deal with ordered pairs of integers