Topic 7:

Relations

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Background

Having collections of data: Good.
Knowing the connections between collections: Better!
Example(s):

Relations (1 / 2)

Definition: (Binary) Relation	
Example(s):	
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Relations (2 / 2)	
Definition: Related	
Example(s):	

Graph Representations of Relations (1 / 2)

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Example #1: Presidents—Parties
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Recall: $A = \{ \text{Kennedy, Johnson, Nixon, Carter, Reagan} \}$ $B = \{ \text{Dem, Rep} \}$ $R = \{ (\text{Kennedy, Dem}), (\text{Johnson, Dem}), (\text{Nixon,Rep}), (\text{Carter, Dem}), (\text{Reagan, Rep}) \}$

- $\operatorname{Kennedy} \bullet$
- $Johnson \bullet$
- Democratic
- Nixon•
- Carter•
- \bullet Republican
- $\operatorname{Reagan} \bullet$

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Graph Representations of Relations (2 / 2)

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

Recall:
$$H = \{1, 2, 3, 4, 5, 6\}$$

$$R = \{(2,1), (3,1), (4,1), (5,1), (6,1), (4,2), (6,2), (6,3)\}$$

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6.

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Properties of Relations: Reflexivity

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Example(s):			
		!	Relations – CSc 144 v1.0 (McCann) – p. 7/26
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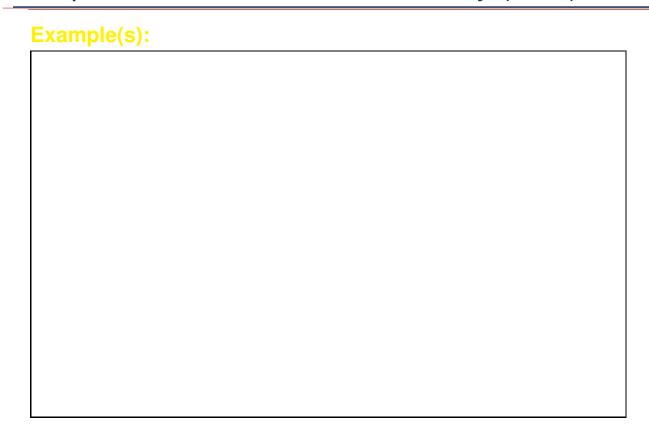
Properties of Relations: Symmetry (2 / 2)

Example(s):	Graph Representations & Symmetr	У
	R	Relations – CSc 144 v1.0 (McCann) – p. 9/26
Properties	of Relations: Antisymme	etry (1 / 2)
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Properties of Relations: Antisymmetry (2 / 2)

Example(s): Graph Representations & Antisymmetr	У
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Properties of Relations: Transitivity (1	/ 2)
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Definition: Transitivity	

Properties of Relations: Transitivity (2 / 2)



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Relational Composition Examples (1 / 4)

Three examples of creating relations from relations.

Example #1: Set Operators

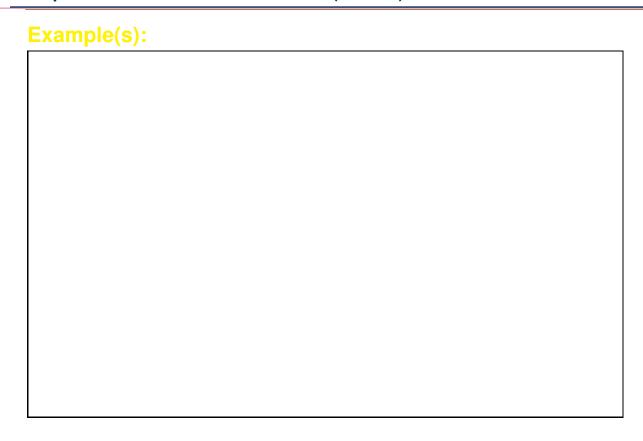
Relational Composition Examples (2 / 4)

Example #2: Swapping content of ordere	ed pairs
Definition: Inverse	
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Relational Composition Exan	nples (3 / 4)
Example #3: Composites	
Definition: Composite	
Example(s):	

Relational Composition Examples (4 / 4)

Example #3: Composites (cont.)	
Example(s):	
Definition: Complement	
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Equivalence Relations (1 / 4)	
Equivalence Relations (1 / 4) You may have already implemented one in Jay	/a
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• , ,	/a
• , ,	/a
You may have already implemented one in Jav	va
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You may have already implemented one in Jav	va

Equivalence Relations (2 / 4)



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Equivalence Relations (3 / 4)

So ... why are these called equivalence relations?

Recall:

$$R = \{ (0,0),$$

$$(1,1), (1,-1), (-1,1), (-1,-1),$$

$$(2,2), (2,-2), (-2,2), (-2,-2) \}$$

Equivalence Relations (4 / 4)

Definition: Equivalence Class
Example(s):
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Partial Orders (1 / 3)
Consider scheduling the construction of a house.
Definition: Defleving (a.k.a. Week) Destiel Order
Definition: Reflexive (a.k.a. weak) Partial Order
Definition: Reflexive (a.k.a. Weak) Partial Order
Definition: Reflexive (a.k.a. weak) Partial Order

Partial Orders (2 / 3)

Example(s):	
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Partial Orders (3 / 3)	
Definition: Irreflexivity (of Relations)	
Definition: Irreflexive (a.k.a. Strict) Partial Order	
Definition: Irreflexive (a.k.a. Strict) Partial Order	
Definition: Irreflexive (a.k.a. Strict) Partial Order	
Definition: Irreflexive (a.k.a. Strict) Partial Order	

Total Orders (1 / 2)

Definition: Comparable	
Definition: Total Order	
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Total Orders (2 / 2)	
Total Orders (2 / 2) Example(s):	