

## Discrete Structures I: Functions and Relations: Relations and Relation Properties

Textbooks: Ensley & Crawley: Chapter 4.1, 4.4, 4.5

Johnsonbaugh: Chapter 3.3

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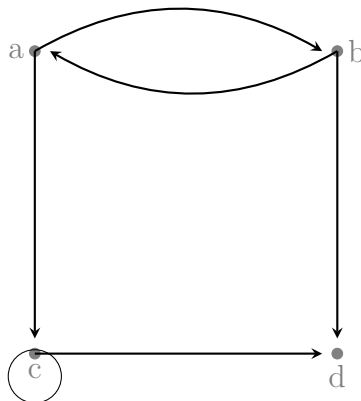
**Instructions:** Work on homework assignments to further familiarize yourself with the topics in the class. The answers are provided for these problems. You can work with other students as desired. Turn in your work on canvas to be given a grade for completion (homework will not be checked for correctness; you need to verify this yourself.)

Upload each homework assignment to its own “dropbox” on Canvas.

This document is not formatted to be written on; do your homework on a separate sheet of paper.

## Functions and Relations: Relations and Relation Properties

1. Write the diagrammed relation as a set of ordered pairs. (The circle is  $(c, c)$ .)<sup>1</sup>



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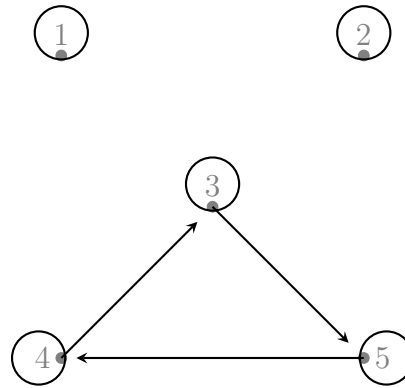
<sup>1</sup>From Discrete Mathematics 7th Ed, Johnsonbaugh, Page 158

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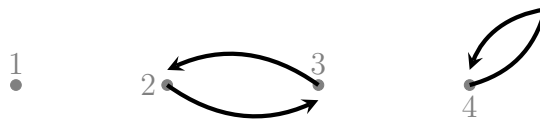
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2. Write the diagrammed relation as a set of ordered pairs. <sup>2</sup>



3. Write the diagrammed relation as a set of ordered pairs. <sup>3</sup>



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<sup>2</sup>From Discrete Mathematics 7th Ed, Johnsonbaugh, Page 158

<sup>3</sup>From Discrete Mathematics 7th Ed, Johnsonbaugh, Page 158

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4. Determine whether each is reflexive, symmetric, antisymmetric, and transitive or not. <sup>4</sup>

a.  $R : \mathbb{Z} \rightarrow \mathbb{Z}$ , where  $(x, y) \in R$  if  $x = y^2$

b.  $R : \mathbb{Z} \rightarrow \mathbb{Z}$ , where  $(x, y) \in R$  if  $x = y$

c.  $R : \mathbb{Z} \rightarrow \mathbb{Z}$ , where  $(x, y) \in R$  if  $x - y = 2$

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<sup>4</sup>From Discrete Mathematics 7th Ed, Johnsonbaugh, Page 158

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5. Given  $A = \{1, 2, 3\}$ ,  $B = \{1, 2, 3, 4\}$   
Draw the diagrams of each of the following.

a.  $R : A \rightarrow A$ , where  $(x, y) \in R$  if  $x > y$ .

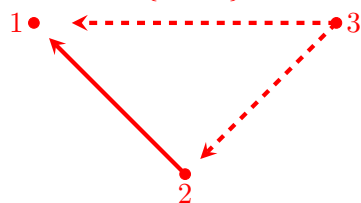
b.  $R : B \rightarrow B$ , where  $(x, y) \in R$  if  $x > y$ .

c.  $R : \wp A \rightarrow \wp A$ , where  $(x, y) \in R$  if  $x \subseteq y$ .

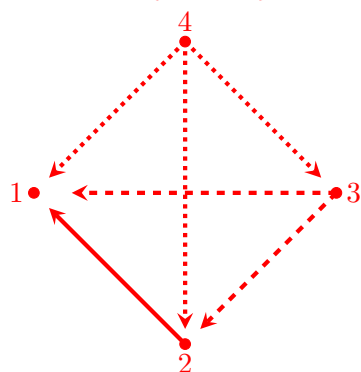
## Answer Key

1.  $\{ (a, b), (b, a), (a, c), (c, c), (c, d), (b, d) \}$
2.  $\{ (1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (4, 3), (3, 5), (5, 4) \}$
3.  $\{ (2, 3), (3, 2), (4, 4) \}$
4.
  - a. Antisymmetric
  - b. Reflexive, symmetric, antisymmetric, transitive
  - c. Antisymmetric

5. a. Given  $A = \{1, 2, 3\}$ ,  $R : A \rightarrow A$ , where  $(x, y) \in R$  if  $x > y$ .



- b. Given  $B = \{1, 2, 3, 4\}$ ,  $R : B \rightarrow B$ , where  $(x, y) \in R$  if  $x > y$ .



- c. Given  $A = \{1, 2, 3\}$ ,  $R : \wp A \rightarrow \wp A$ , where  $(x, y) \in R$  if  $x \subseteq y$ .

