

## MATH 102: HOMEWORK 5

DUE DATE: TUES, NOV 14

*Problem 1.* Describe  $\mathbb{R} \times \mathbb{N}$  using set notation. What is a graphical representation of this set? (For this, make sure you know how to insert figures in LaTeX).

- Problem 2.*
- (1) Is the set  $([0, 1] \cup [1, 2]) \times ([2, 3] \cup [3, 4])$  the same with  $([0, 1] \times [2, 3]) \cup ([1, 2] \times [3, 4])$ ?
  - (2) Let  $A, B, C, D$  be sets. What must be true for the relationship between  $(A \cup B) \times (C \cup D)$  and  $(A \times B) \cup (B \times D)$ ?
  - (3) Prove your claim in (2).

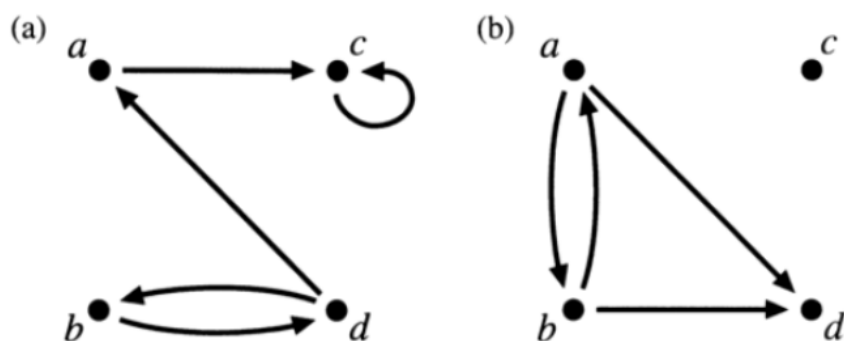
*Problem 3.* Prove that

- (1)  $A \times (B \cap C) = (A \times B) \cap (A \times C)$
- (2)  $(A \cap B) \times (C \cap D) = (A \times B) \cap (B \times D)$

*Problem 4.* Let  $R$  be a relation from  $A$  to  $B$  and  $S$  be a relation from  $B$  to  $C$ . We define the composition of relations  $S \circ R$  as follows

$$S \circ R = \{(a, c) \in A \times C \mid \exists b \in B, (a, b) \in R \wedge (b, c) \in S\}.$$

Consider the following graphs.



Let  $R$  be the relation in (a) and  $S$  be the relation in (b).

- (1) Write, in set notation,  $S \circ R$ .
- (2) Draw  $S \circ R$ .

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*Date:* November 7, 2023.