Table 3.5.1: Set identities.

Name	Identities	
Idempotent laws	A U A = A	$A \cap A = A$
Associative laws	(A U B) U C = A U (B U C)	$(A \cap B) \cap C = A \cap (B \cap C)$
Commutative laws	A U B = B U A	A ∩ B = B ∩ A
Distributive laws	$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$	$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
Identity laws	A U Ø = A	$A \cap U = A$
Domination laws	$A \cap \emptyset = \emptyset$	A U U = U
Double complement law	$\overline{\overline{A}} = A$	
Complement laws	$A \cap \overline{A} = \emptyset$ $\overline{U} = \emptyset$	$A \cup \overline{A} = U$ $\overline{\varnothing} = U$
De Morgan's laws	$\overline{A \cup B} = \overline{A} \cap \overline{B}$	$\overline{A \cap B} = \overline{A} \cup \overline{B}$
Absorption laws	A ∪ (A ∩ B) = A	A ∩ (A ∪ B) = A

Feedback?



S.5.1: Name the set identity.



Name the set identity that is used to justify each of the identities given below.

- (a) (Bnc) UBnc = U Complement law
- (b) AU(ANB) = A Absorztion law (c) AU(BNC) = AU(BUC) De Morgan's law

EXERCISE

3.5.2: Proving set identities.



Use the set identities given in the table to prove the following new identities. Label each step in your proof with the set identity used to establish that step.

- (a) $(\overline{A} \cap C) \cup (A \cap C) = C$
- (b) $(B \cup A) \cap (\overline{B} \cup A) = A$

(a) (Anc)U(Anc) (4) (ANC)U(ANC) (CNA) U (CNA) Commutative 19w $C \cap (\overline{A} \cup A)$ cn (AUĀ) CNV

Distributive law Commutative law comprement law I destity lav

: (Anc)U(Anc)=c

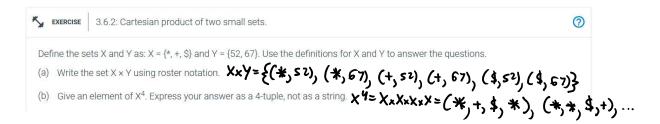
(*b*) (BUA) (BUA) (AUB) N (AUB) AU CBNB) AUØ A

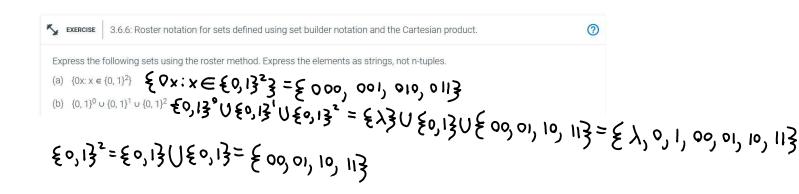
commutative law Distributive law Comprement law Identity lav

: (BUA) (BUA) = A

3.6 - Cartesian products

Wednesday, June 7, 2023 7:03 PM





3.7 - Partitions

Wednesday, June 7, 2023 7:31 PM

Two sets, A and B, are said to be **disjoint** if their intersection is empty $(A \cap B = \emptyset)$. A sequence of sets, A₁, A₂, ..., A_n, is **pairwise disjoint** if every pair of distinct sets in the sequence is disjoint (i.e., A_i \cap A_i = \emptyset for any i and j in the range from 1 through n where i \neq j).

A **partition** of a non-empty set A is a collection of non-empty subsets of A such that each element of A is in exactly one of the subsets. A_1 , A_2 , ..., A_n is a partition for a non-empty set A if all of the following conditions hold:

For all i, A_i ⊆ A.

= (subset)

- For all i, A_i ≠ Ø
- A₁, A₂, ...,A_n are pairwise disjoint.
- A = A₁ U A₂ U ... U A_n



3.7.1: Recognizing partitions - small finite sets.



Define the sets A, B, C, D, and E as follows:

- $A = \{1, 2, 6\}$
- B = {2, 3, 4}
- C = {5}
- D = $\{x \in \mathbb{Z}: 1 \le x \le 6\}$
- E = {x ∈ **Z**: 1 < x < 6}

Use the definitions for A, B, C, D, and E to answer the questions.

- (a) Do the sets A, B, and C form a partition of the set D? If not, which condition of a partition is not satisfied?
- (b) Do the sets B and C form a partition of the set D? If not, which condition of a partition is not satisfied?
- (c) Do the sets B and C form a partition of the set E? If not, which condition of a partition is not satisfied?

(a) The sets A, B, & C to not form a partition of the set D. ANB= £53 + Ø, the sets are not disjoint, if they to not form a partition.

(b) The sets BEC to not form a partition of the sets to not form a partition.

The sets to not form a partition.

BUC={2,3,4,5}={XEZ:12x46}=E: the sets form a partition.

EXERCISE

3.7.3: Recognizing partitions - the real numbers.

(?)

Define the sets A, B, C, D, and E as follows:

- $A = \{x \in \mathbb{R}: x < -2\}$
- $B = \{x \in \mathbb{R}: x > 2\}$
- · C = {x ∈ R: |x| < 2} = {x ∈ R: -2 < x < 2}
- D = {x ∈ R: |x| ≤ 2}
 E = {x ∈ R: x ≤ -2}
 E = {x ∈ R: x ≤ -2}

Use the definitions for A, B, C, D, and E to answer the questions.

- (a) Do the sets A, B, and C form a partition of R? If not, which condition of a partition is not satisfied?
- (b) Do the sets A, B, and D form a partition of R? If not, which condition of a partition is not satisfied?
- (c) Do the sets B, D, and E form a partition of R? If not, which condition of a partition is not satisfied?

(a) The sets A, B, C do not form a partition of R. ANBN(= ξ -2,2 $\}$ # ξ Ø $\}$, the sets are not dissoint, : they do not form a partition.

(b) $A \subseteq R$, $B \subseteq R$, $D \subseteq R$, $A \neq \emptyset 3$, AUBUD= {x \in \mathbb{R}: -\alpha < x < \alpha \} : the sets form a partition.

(c) The sets B, D, & E to not form a partition of R. DNE= \(-23 \neq \D, \) the sets are not disjoint, . .1.1

if they do not form a partition.