CIS 185
Practice 6b
Objective:

- Be able to prove set identities
- Be able to understand Cartesian products

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Exercise 1: Let A, B, and C be sets. Show that A ∪ (B ∩ C) = (C ∪ B) ∩ A.

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$= (C \cup B) \cap A$

Exercise 2: Let A, B, and C be sets. Show that $\bar{A} \cup (A \cap B) = \bar{A} \cup B$.

$\bar{A} \cup (A \cap B) = (\bar{A} \cup B) \cap (\bar{A} \cup A)$

$= \bar{A} \cup B \cap U = \bar{A} \cup B$

Exercise 3: Use set builder notation and logical equivalences to establish the first De Morgan law $\overline{A \cap B \cap C} = \bar{A} \cup \bar{B} \cup \bar{C}$.

$\overline{A \cap B \cap C} = \{x \mid x \notin A \cap B \cap C\}$ complement

$= \{x \mid \neg(x \in (A \cap B \cap C))\}$ does not belong symbol

$= \{x \mid \neg(x \in A \wedge x \in B \wedge x \in C)\}$ intersection

$= \{x \mid \neg(x \in A) \vee \neg(x \in B) \vee \neg(x \in C)\}$ Demorgans

$= \{x \mid x \notin A \vee x \notin B \vee x \notin C\}$ does not belong symbol

$= \{x \mid x \in \bar{A} \vee x \in \bar{B} \vee x \in \bar{C}\}$ complement

$= \{x \mid x \in \bar{A} \cup \bar{B} \cup \bar{C}\}$ union $= \bar{A} \cup \bar{B} \cup \bar{C}$

Exercise 4:
Let A = {a, b, c}, B = {x, y}, and C = {0, 1}. Find
a) A × B.

$\{(a,x), (a,y), (b,x), (b,y), (c,x), (c,y)\}$

b) C × B × A.

$\{(0,x,a), (0,x,b), (0,x,c), (0,y,a), (0,y,b), (0,y,c),$
$(1,x,a), (1,x,b), (1,x,c), (1,y,a), (1,y,b), (1,y,c)\}$