Discrete Structures and Theory (Spring 2023)
Week 10 Discussion
Date: 20/03/2023

Exercise 1:

For each of these pairs of sets, determine whether the first is a subset of the second, the second is a subset of the first, or neither is a subset of the other.

a) the set of airline flights from New York to New Delhi, the set of nonstop airline flights from New York to New Delhi

b) the set of people who speak English, the set of people who speak Chinese

c) the set of flying squirrels, the set of living creatures that can fly

Exercise 2:

Determine whether each of these statements is true or false.

a) $0 \in \emptyset$ b) $\emptyset \in \{0\}$ c) $\{0\} \subset \emptyset$

d) $\emptyset \subset \{0\}$ e) $\{0\} \in \{0\}$ f) $\{0\} \subset \{0\}$

g) $\{\emptyset\} \subseteq \{\emptyset\}$ h) $x \in \{x\}$ i) $\{x\} \subseteq \{x\}$

k) $\{x\} \in \{x\}$ l) $\{x\} \in \{\{x\}\}$

Exercise 3:

Find two sets A and B such that A ∈ B and A ⊆ B.

Exercise 4:

Let $A = \{a, b, c, d\}$ and $B = \{y, z\}$. Find

a) $A \times B$.
b) $B \times A$.

Exercise 5:

What is the Cartesian product $A \times B$, where A is the set of courses offered by the mathematics department at a university and B is the set of mathematics professors at this university? Give an example of how this Cartesian product can be used.

Exercise 6:

Find A^2 if

a) $A = \{0, 1, 3\}$.
b) $A = \{1, 2, a, b\}$.

Exercise 7:
Suppose that A, B, and C are sets such that $A \subseteq B$ and $B \subseteq C$. Show that $A \subseteq C$.

Exercise 8:
Let A, B, and C be sets. Show that
a) $(A \cap B) \subseteq A$.
b) $A \subseteq (A \cup B)$.
c) $A - B \subseteq A$.

Exercise 9:
What can you say about the sets A and B if we know that
a) $A \cup B = A$?
b) $A \cap B = A$?
c) $A - B = A$?
d) $A \cap B = B \cap A$?
e) $A - B = B - A$?

Exercise 10:
Show that if A is a subset of a universal set U, then
a) $A \oplus A = \emptyset$.
b) $A \oplus \emptyset = A$.
c) $A \oplus U = \bar{A}$.
d) $A \oplus \bar{A} = U$.

Hint: Recall that $A \oplus B = (A - B) \cup (B - A)$