

## Set theory: overview (so far)

- Concepts: set, elements of a set, cardinality
- Subsets: a set  $A$  is a subset of set  $B$  if every element of  $A$  is an element of  $B$ .
- Set operations: intersection, union, complement, difference
- Associative, distributive, de Morgan Laws
- Proofs with sets

## Today:

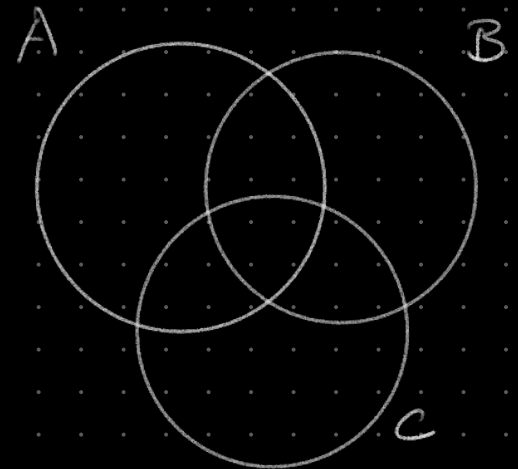
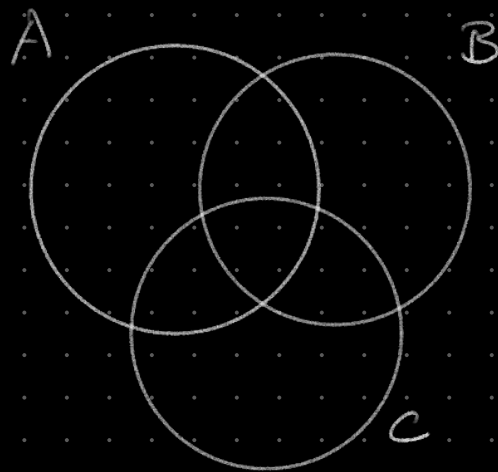
- Proofs with sets: another example
- Power sets
- Partitions
- Product sets

Book: Chapter 2, sections 2.4 and 2.6

# Proofs with sets: recap

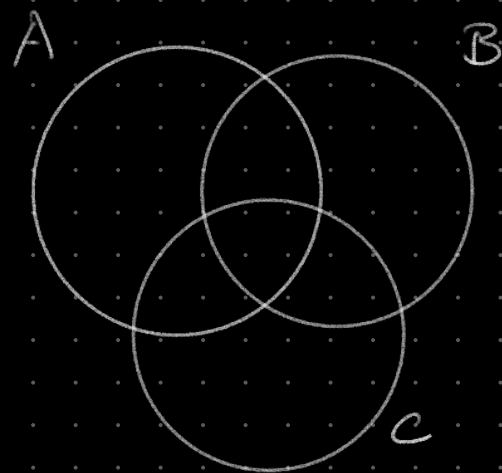
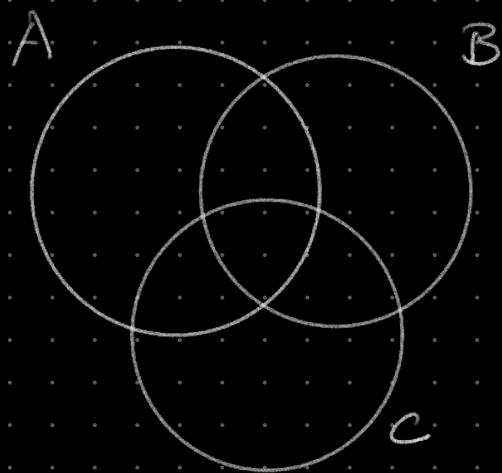
- To prove that  $A \subseteq B$ , show that
  - $x \in A \implies x \in B$
- To prove that  $A=B$ 
  - $A \subseteq B$
  - $B \subseteq A$
- Statements can be proved by (a combination of)
  - using the definitions
  - using laws
  - converting to propositional logic.
- To get an intuition, you can draw a Venn diagram first.

For all sets  $A, B, C$ ,  $(B \cap (A^c \cup C)^c = \emptyset) \Leftrightarrow (A \subseteq B^c \cup C)$ .





For all sets  $A, B, C$ ,  $(B \cap (A^c \cup C^c) = \emptyset) \Leftrightarrow (A \subseteq B^c \cup C)$ .



# Power sets

The **power set** of a set  $A$  is the set of all subsets of  $A$

# Product sets

For two sets  $A$  and  $B$ , the **product set**  $A \times B$  is defined as





Set partitions



# Checklist: set theory

- Do you know how set membership works?
- Do you understand the meaning of the set operators (complement, intersection, union, difference)
- Do you know how to use Venn diagrams to develop an intuition
- Do you understand the concept and definition of subset?
- Do you know how to prove that two sets are equal?
- Do you understand how to use the associative, distributive and de Morgan laws? Can you prove them?
- Do you know how to use power sets? Can you formulate the power set of a (finite) set?
- Do you understand how set product works?
- Do you know what a partition is?