Lecture Notes: Section 2.3

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1 Overview

Key Points

- Set Notation
- Operations on Sets
- Distributive and DeMorgan's Laws

2 Detailed Notes

2.1 Set Notation

We write sets with noation as follows

$$\{a_1, a_2, a_3, a_4, a_5\} \tag{1}$$

This is a set with 5 elements and there doesn't have to be any relation with the elements

$$\{\text{apple, 5, blue, } -\frac{1}{2}\} \tag{2}$$

This is a example of a set wtih 4 elements that have no relation to each other
We might sometimes let $\mathbb{S}$ denoate a universal set of everything we are considering

$$A \subsetneqq B \text{ or} A \subset B \text{ means A is a subset of B} \tag{3}$$

Null set notation

$$\phi \text{ is a empty set. The empty set has no elements} \tag{4}$$

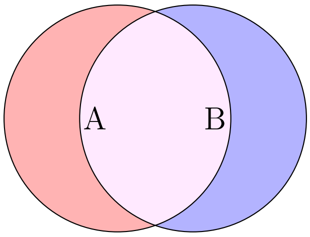
$$\text{For any set A, the empty set is a subset of A} \phi \subsetneqq A \tag{5}$$

2.2 Operations on Sets

If A and B are sets we are going to make some other sets

Union

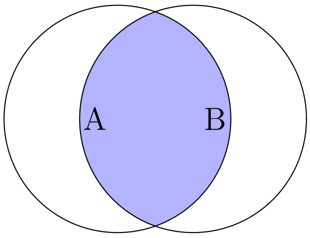
$$A \cup B \text{ is a set of everything that is in A or B} \tag{6}$$



Union: $A \cup B$

Intersection

$$A \cap B \text{ is a set of everything that is in A and B} \tag{7}$$



Intersection: $A \cap B$

The compliment of a Set A is $\overline{A}$

$$A \in \overline{A} \text{ means} x \notin A (\text{x is not in A}) \tag{8}$$

Two sets are disjoin or mutually exclusive if $A \cap B = \phi$

3 Important Formulas/Theorems/Definitions

Key Formula/Theorem

DeMorgan and Distributive Laws

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C) \tag{9}$$

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C) \tag{10}$$

$$\overline{(A \cap B)} = \overline{A} \cup \overline{B} \tag{11}$$

$$\overline{(A \cup B)} = \overline{A} \cap \overline{B} \tag{12}$$

4 Examples

Flip a coin twice

$$s = \{HH, HT, TT\} \tag{13}$$

$$\text{Let } A = \{HH, HT\},\ \text{the set of outcomes with heads on the first flip} \tag{14}$$

$$B = \{HH, TT\} \text{ the set of outcomes where both flips are the same} \tag{15}$$

$$\text{Then } A \cup B = \{HH, HT, TT\} \text{ and} A \cap B = \{HH\} \tag{16}$$

The compliments for both of these sets are then

$$\overline{A} = \{TH, TT\}$$
$$\overline{B} = \{HT, TH\}$$

5 Questions/Topics for Further Study

- Question or topic for further study