

MATH1081 notes

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1 1.1: Introduction

1. addition, multiplication, division and subtraction
2. Mainly dealing with finite sets

2 1.2: Sets and subsets

A set is a well defined collection of distinct objects

Example: $S = \{1, a, 3\}$, $A = \{\Pi, 1\}$.

1. $e \notin A$; it is not in A
2. For example, if A is a set of all integers; $\{\text{all even integers}\} = \{n \in \mathbb{R} | n \text{ is even}\}$.
3. We can remove superfluous items (elements that occur more than one).
 $A = \{1, 2, 3, 3\}$ where 3 can be removed.

Example:

$A = \{1, 2, 3\}$, $B = \{2, 3, 1\}$, $C = \{1, 2, 3, 3\}$, $D = \{1, 3\}$.

Here, D is a proper subset of A, B, C; A, B, C are supersets of D.

\subseteq : Subset (proper subset), \supseteq : Superset.

1. To prove if a set is a proper subset; do the following:

For example, if $D \in A$, then check if $e \in D$

If $e \in D$, then $e \in A$. Thus, it would be a proper subset (here, e is just an element).

2. To prove that two sets are equal;

For example, if $A = B$, prove:

- i) $A \subseteq B$; if an element is in A, then the element is in B.
- ii) $B \subseteq A$; if an element is in B, then the element is in A.

3 1.3: Power Sets and Stability

Subsets of $A = \{1, 2, 3\}$:

1. Could throw everything out to get empty set Φ ,
2. One element each: $\{1\}, \{2\}, \{3\}$,
3. Two elements: $\{1, 2\}, \{2, 3\}, \{1, 3\}$,
4. Set itself: A .

The set containing 1, 2, 3, 4 is called the powerset of A.

Given $A = \{1, 2, 3\}, B = \{1, 2, 3, 3\}, C = \{1, 3\}, D = \{1, 3\}$, where $A = B, C \subseteq A, B$ and $D \not\subseteq A, B, C$.

1. size of A = 3, B = 3, C = 2, D = 2.

[Exercise with A = 0, 1, 0, 1, B done in word].

3.1 1.4: Set Operations

Boolean Operators ("not" operation in programming):

1. Complement:

Let there be a set A in U (A : all of the people in the video, U : universal set of everyone in the world, A^c = complement of A).

$$A^c = \{x \in U | x \notin A\}.$$

2. Intersecting ("and" operation in programming):

If there is A, B , intersecting,

$$A \cap B = \{x \in A | x \in B\}.$$

3. Union ("or" operation in programming): If there is A, B , A or B is:

$$A \cup B = \{x \in U | x \in A \text{ or } x \in B\}.$$