COMP0147 Discrete Mathematics for Computer Scientists Notes

Joe

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Notes adapted from lecture notes by Max Kanovich and Robin Hirsch [1].

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Chapter 1

Foundations

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1.1 Set Theory and Functions

1.1.1 Set Notations

- Set definition: $A = \{a, b, c\}$
- Set membership (element-of): $a \in A$
- Set builder notation: $\{x \mid x \in \mathbb{R} \wedge x^2 = x\}$
- Empty set: $\emptyset$

1.1.2 Properties

- No structure
- No order
- No copies

For example, a, b, c are references to actual objects in

$$\{a, b, c\} \Leftrightarrow \{c, a, b\} \Leftrightarrow \{a, b, c, b\}$$

1.1.3 Set Equality

Definition 1.1.1 (Set Equality). Set $A = B$ iff:

1. $A \subseteq B \implies \forall\, x(x \in A \rightarrow x \in B)$
2. $B \subseteq A \implies \forall\, y(y \in B \rightarrow y \in A)$

Remark. $A = B \Leftrightarrow A \subseteq B \wedge B \subseteq A$

1.1.4 Set Operations

- *Union*: $A \cup B \equiv \{x \mid x \in A \vee xinB\}$
- *Intersection*: $A \cap B \equiv \{x \mid x \in A \wedge x \in B\}$
- *Relative Complement*: $A \setminus B \equiv \{x \mid x \in A \wedge x \notin B\}$
- *Absolute Complement*: $A^c \equiv U \setminus A \equiv \{x \mid x \in U \wedge x \notin A\}$
- *Symmetric Difference*: $A \Delta B \equiv (A \setminus B) \cup (B \setminus A) \equiv (A \cup B) \setminus (A \cap B)$
- *Cartesian Product*: $A \times B \equiv \{(x, y) \mid x \in A \wedge y \in B\}$

Bibliography

[1] Max Kanovich and Robin Hirsch.
"Lecture Notes on Discrete Mathematics for Computer Scientists".
URL: http://www.cs.ucl.ac.uk/1819/a4u/t2/comp0147_discrete_mathematics_for_computer_scientists/.