

CS5070 Mathematical Structures for Computer Science

- Additional Notes

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Using Natural Numbers

- \mathbb{N} is a set of natural numbers

$$\mathbb{N} = \{0, 1, 2, 3 \dots\}$$

- The set A of all even natural numbers can be denoted as:

$$A = \{0, 2, 4, 6, \dots\}$$

- A complete mathematical expression to denote this is:

$$A = \{\forall x \in \mathbb{N} : \exists n \in \mathbb{N} (x = 2n)\}$$

- A semi-formal expression is:

$$A = \{x \in \mathbb{N} \mid x \text{ is even}\}$$

- The set of odd numbers can be formally denoted as:

$$B = \{\forall x \in \mathbb{N} : \exists n \in \mathbb{N} (x = 2n - 1)\}$$

More properties Using Natural Numbers

- To define a set of natural numbers with every natural number is even or odd:

$$C = \{\forall x \in \mathbb{N} : \exists n \in \mathbb{N} (x = 2n) \vee (x = 2n - 1)\}$$

- To express the fact that there is an odd number between every two (consecutive) natural even numbers:

$$\forall x \in \mathbb{N} \forall y \in \mathbb{N} : \exists z \in \mathbb{N} \exists n \in \mathbb{N} \\ (x = 2n) \wedge (y = 2n + 2) \wedge (x < z) \wedge (y < z)$$

- The set of integers; positive and negative whole numbers is denoted as \mathbb{Z} . Using this, we can define the set:

$$E = \{x \in \mathbb{Z} : x^2 \in \mathbb{N}\}$$