Languages and Computation

Reducing Computation to Language Membership.
A Problem is More Complex if the Language is More Complex.
Simple Problems with simple machines that solve them.

2. \(|\mathbb{N}| = |\mathbb{N} \cup \{0\}|\). That seems counterintuitive!

3. Comparing to \(\mathbb{N}\) means list the elements.

4. The sizes of \(\mathbb{N}, \mathbb{Z}, \mathbb{Q}, \text{Evens}, \text{Odds}\) are all the same.

5. \(\mathbb{R}\) is bigger than \(\mathbb{N}\).

6. The power set (set of all subsets) is strictly bigger - for \textit{any} set.

7. Infinity is a complicated thing.
Today: Infinite Sets

1. Some simple computational problems.

2. Representing these problems as language membership.

\[ L_{\text{push on}}, L_{\text{switch on}}, L_{\text{door}}, L_{\text{graph}}. \]

3. Computation equals determining the membership of an input string in a language.

4. Simple computational problems result in easy to define and test languages.

5. Complexity of computation corresponds to complexity of the corresponding language.

6. Simple machines that can solve the problems encoded in \( L_{\text{push on}}, L_{\text{switch on}} \).