Lec 1/8

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Definitions:

1. set - collection of elements (distinct). a multiset allows for multiplicities.

2. $A \cap B$, $A \cup B$, $A - B$, $A \times B$

3. A binary relation on A and B is a subset of $A \times B$.

4. Let D & R be sets. $f \subseteq D \times R$ is a function (on D) if $(a,b), (a,c) \in f \Rightarrow b = c$. binary relation
   and $\forall a \in D, \exists b \in R$ s.t. $(a,b) \in f$

   $f: D \longrightarrow R$.

   if $(a,b) \in f$, write $f(a)$ to denote b (uniquely).

5. $f: A \to B$ is

   a) one-to-one (injective) if $f(a) = f(b) \Rightarrow a = b$.

   b) onto (surjective) if $\forall b \in B \; \exists a \in A$ s.t. $b = f(a)$

   c) a one-to-one correspondence (bijective) if it's one-to-one and onto.

starts at 0. if $n=0$, $S = \emptyset$.

6. S is finite if there is a one-to-one correspondence between S and $\{1, 2, \ldots, n\}$ for some $n \in \mathbb{N}$
   a set that is not finite is called infinite.

7. S is countably infinite if $\exists$ a one-to-one correspondence $f: S \to \mathbb{Z}^+$. ($\mathbb{Z}^+ = \mathbb{N} - \{0\}$)
   A set is countable if it's finite or countably infinite.

Gödel numbering: $f: \mathbb{Z}^+ \times \mathbb{Z}^+ \longrightarrow \mathbb{Z}^+$

where $f(x,y) = 2^x 3^y$

Lemma? if S is a set and $\exists$ a one-to-one mapping $f: S \longrightarrow \mathbb{Z}^+$
then S is countable.