Programs

- finite length string of 0's and 1's

set of all programs

n	$f(n)$
1	0
2	1
3	00
4	01
5	10
6	11
7	000
⋮	⋮

countable

Functions $G: \mathbb{Z}^+ \to \{0,1,2,\dots 9\}$

T set of all such functions

T is uncountable

Let $S = \mathbb{R}$ between 0..1

Define $F: S \to \cancel{T}$ subset of T

$F(0.a_1a_2a_3\cdots a_n\cdots) =$ function $f(n) = a_n$

subset of T for co-domain is the image (range) of F

so F is onto

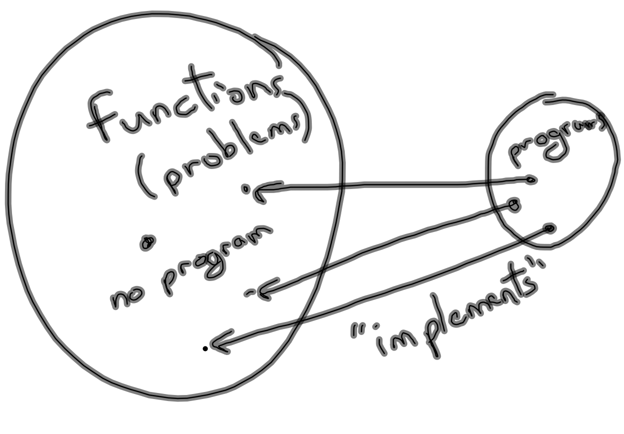
$F(x_1) = F(x_2)$

↳ f^1 ↳ f^2

so $x_1 = x_2$ → so F is one to one

so subset of T is uncountable

so T is "



for all integers $n \geq 0$,

$$2^n < (n+2)!$$

Basis: $n = 0$

$$2^0 = 1$$

$$(0+2)! = 2! = 2$$

$$0 < 2 \checkmark$$

Induction: suppose statement is true for $n = k$

$$2^k < (k+2)!$$

[show true for $n = k+1$ so $2^{k+1} < ((k+1)+2)!$]

subst ind hyp

$$\begin{aligned} 2^{k+1} = 2 \cdot 2^k &< 2 \cdot (k+2)! \\ &< 3 \cdot (k+2)! \\ &< (3+k) \cdot (k+2)! \\ &= (k+3)(k+2)! \\ &= ((k+1)+2)! \end{aligned}$$

$$X = \{a, b\}$$

$$Y = \{u, v\}$$

$$X \times Y = \{(a,u), (a,v), (b,u), (b,v)\}$$

$$\mathcal{P}(X) = \{\{\}, \{a\}, \{b\}, \{a,b\}\}$$

$$\mathcal{P}(X \times Y) = \{\{\}, \{(a,u)\}, \{(a,v)\} \ldots$$

$$\{(\quad),(\quad)\} \ldots$$

$$\{(\quad),(\quad),(\quad)\} \ldots$$

$$\{(a,u),(a,v),(b,u),(b,v)\}\}$$