Hi
Non-deterministic TM

\[ S_1, S_2, S_3, B_1, S_4, S_5, S_6 \]

Build strings
- first by length
- then by symbol

Diagram showing configuration nodes and transitions.
transitions: a, b, c, d

Lexicographical order.
Every non-deterministic TM has an equiv. det. TM.

1. Tape 1 is input, tape 2,3 are empty.
2. Copy tape 1 to tape 2.
3. Use tape 3 to make configuration decisions (w/ address in the config tree).
   If accept state is reached, then accept.
   If reject state is reached or we run out of transitions on tape 3, then go to 4.
4. Replace tape 3 w/ next address string and go to 2.
Algorithms

Hilbert's Problems

#10 devise an algorithm that tests whether a polynomial has integral roots.

\[ D = \{ p \mid p \text{ is a polynomial with integral roots} \} \]

\[ D \text{ is Turing recognizable, but not decidable.} \]

\[ D_1 = \{ p \mid p \text{ is a polynomial over } x \text{ with integral roots} \} \]

TM \( M \), recognizes \( D_1 \)

1. input: polynomial over \( x \)
2. evaluate \( p \), w/ \( x \) set to \( 0, 1, -1, 2, -2, 3, -3, \ldots \)
   if \( p(x) = 0 \), accept.

\( D_1 \) is also decidable, roots must be in

\[ \pm k \frac{c_{\text{max}}}{c}, \]

\( k \): # terms
\( c_{\text{max}} \): largest abs. val of coeff
\( c \): coeff of the highest order term.