CS 3313
Foundations of Computing:

Lab 7

Turing Machine

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  - A tape input in Γ

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- Convention
  - Just as with NFAs and PDAs, if transition is undefined TM goes to reject state
  - If TM enters reject state it halts and rejects
  - If TM enters accept state, it halts and accepts

Church-Turing Thesis

Anything that can be computed by an algorithm can be computed by a Turing Machine

Three Steps to Build a TM

1. Write an algorithm
   - Describe at a high-level the logic for recognizing L
   - By Church-Turing thesis, this describes a TM
2. Write a Turing-Machine algorithm
   - Specify what happens to the tape (i.e., scan the tape until the first 1 and write a 0)
   - Don’t need to specify the control states
   - This is usually enough – unless asked for the formal specification
3. Write the full specification
   - Includes full specification of transition function and states of control machine (remember that this is a DFA/NFA)

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  - How do we check the two strings are equal (we already saw how to do this in class)?

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- Composing TMs
  - Just like we compose algorithms
  - Design TM for step 1, and then step 2 and call one after the other

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- Step 2: Write a Turing-Machine Algorithm
  - Describe what how to manipulate the tape

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- Step 3: Write a full description
  - Give the transition diagram for the TM

Exercise 2: $L = \{ a^i b^j c^i d^j \mid i,j>0 \}$

- Built TM to decide L