Name?

Σ, δ, Γ, Q

92/100

Department of Computer Science
University of Massachusetts Lowell
COMP.3040 Foundations of Computer Science
Fall 2017
Quiz 2 [5%]
11/30/2017

1. Give the formal definition of a Turing Machine (TM)

A Turing machine is a 7 tuple relation $(Q, \Sigma, \delta, \Gamma, Q, q_0, q_{accept}, q_{reject})$ where Σ, δ, Γ are all finite sets

Q: Finite set of states

Σ: Input alphabets not inc. ␣, blank symbols

δ: Tape input

Γ: $Q \times \Gamma, Q \times \Gamma \times \{L, R\}$ where is the transition function

q_0: $q_0 \in Q$ is the start state

q_{accept}: $q_{accept} \in Q$ is the accept state

q_{reject}: $q_{reject} \in Q$ is the reject state

$q_{accept} \neq q_{reject}$

2. What is an Enumerator?

Turing machine attached to a printer

3. What is Church-Turing Thesis?

~~Turing algo equals a machine algorithm~~

The intuitive notion that ~~algorithms~~ algorithms equals turing machine algorithm

4. A multi-tape TM is more powerful than a single tape TM.

- True
- (•) False

5. A Non-deterministic TM is more powerful than a Deterministic TM.

- True
- (•) False

6. Order the class of languages in increasing order of power

- Context Free (2)
- Regular (1)
- Turing Recongnizable (4)
- Turing Decidable (3)

7. A = { $0^{2^n}, n >= 0$, is a decidable/recognizable language }

- Decidable
- (•) Recognizable

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8. A_{DFA} = { (B, w) | B is a DFA that accepts input string w, is a decidable/recognizable language }

- (•) Decidable
- Recognizable

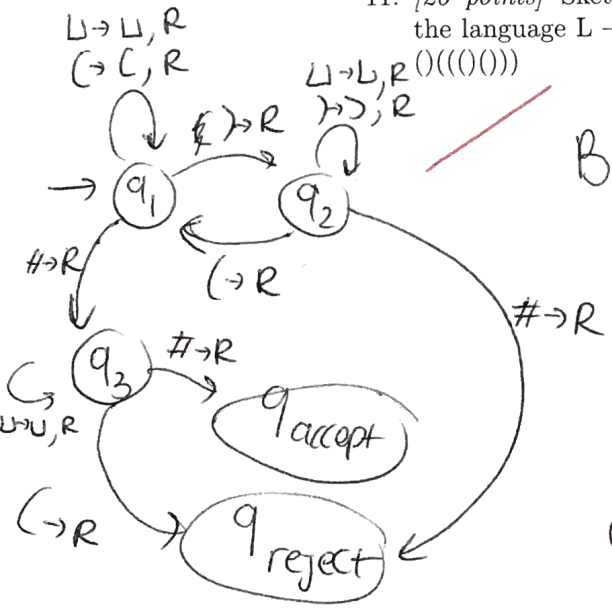
9. A_{REX} = { (R, w) | R is a Regular Expression that generates string w, is a decidable/recognizable language }

- (•) Decidable
- Recognizable

10. A_{CFG} = { (G, w) | G is a CFG that generates string w, is a decidable/recognizable language }

- (•) Decidable
- Recognizable

11. *[20 points]* Sketch an algorithm using a single tape TM to recognize the language L — contains matching paranthesis; for example (()()) and ()((()()))



= End of string symbol ␣ = blank symbol

Based on the state diagram shown of a single tape TM, to recognize language L, a suitable algorithm should be written to perform the following task in the given order

(1) If a string contains just an "#" symbol for empty string successfully accept language by either return 1 or succesn output

" ␣ for blank, keep looping till find the next '(' or ')'

(3) At any point during state transition if encounter "␣", loop at that state

(2) Otherwise, process language as shown following the state diagram

q_3 is third state, it looks for "#" to move to q_{accept} ↳return 1 or succesn output or looks for "(" to move to q_{reject} ↳return 0 or failure output

q_1 is the starting state, it looks for ')' to move to q_2 or '#' to move to q_3

q_2 is the second state, it looks for '(' to move to q_1 or '#' to move to q_{reject} ↳return 0 or failure