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COMP.3040 Foundations of Computer Science
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Quiz 2 [5%]
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1. Give the formal definition of a Turing Machine (TM)

A Turing Machine is a 7-tuple, $(Q, \Sigma, \Gamma, \delta, q_0, q_{accept}, q_{reject})$
Q is a finite set of states
Σ is the input alphabet not containing the blank symbol
Γ is the tape alphabet. δ is transition function. q_0 is the start state. q_{accept} is the accept state
q_{reject} is the reject state where $q_{reject} \neq q_{accept}$

2. What is an Enumerator?

An enumerator is a Turing machine with an attached printer.

3. What is Church Turing Thesis?

Church-Turing Thesis is the intuitive notion of algorithms equals the Turing machine algorithms.

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

8 • True
• False

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

4 • True
• False

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

(1) • Context Free
(2) • Regular
(4) • Turing Recognizable
(3) • Turing Decidable

7. $A = \{ 0^n 1^n \mid n >= 0 \}$ is a decidable/recognizable language ?

9 • Decidable
• Recognizable

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

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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 ()((()()))

For (()()) and ()((()())))

① At start, the input string appears on the tape and it will start parsing the left to right.

② Mark the symbol and remember if it's "("

③ Move to the right and find the ")" if there is another "(", keep looking until found ")". the first ")" will be matched with the last "(".

④ repeat the process until it found all complored pair of parenthesis

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