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88 ×5

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COMP.3040 Foundations of Computer Science
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Quiz 2 [5%]
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Q: sets of states

Σ: input alphabets (not containing blank symbol $\sqcup$)

Γ: tape alphabet, where $\sqcup \in \Gamma$ and $\Sigma \subseteq \Gamma$

$\delta: Q \times \Gamma \to Q \times \Gamma \times \{L,R\}$ transition function

$q_0 \in Q$: start state

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

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

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

1. *[10 points]* How does a Turing Machine (TM) work?

TM uses the tape to read in all the inputs.

−5

2. *[10 points]* Give the formal definition of a Turing Machine (TM)

TM is a machine that has 7 tuples $Q, \Sigma, \Gamma, \delta, q_0, q_{accept}, q_{reject}$, where Q, Σ, Γ are finite sets.

3. *[10 points]* What is an Enumerator? Give an example.

is a TM with an attached printer. It starts with a blank input on its work tape −2

4. *[10 points]* What is Church-Turing Thesis?

is the connection between the informal notion of algorithm and the precise definition

5. *[10 points]* What is Turing-Recognizable Language?

is the set of language consist of those strings which can be recoginzed by a TM as an input.

6. *[10 points]* What is Turing-Decidable Language?

is set of language consists of those strings which can be the choices of a TM where it making decisions.

7. *[5 points]* A multi-tape TM is not more powerful than a single tape TM.

- **True**
- False

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8. *[5 points]* A Non-deterministic TM is more powerful than a Deterministic TM.

- True
- False

9. *[5 points]* A TM cannot recognize a CFL language.

- True
- False

10. *[25 points]* Sketch an algorithm using a single tape TM to recognize the language $L \mid ww^R$, where w is a string and w^R is the reverse of the string. Assume $\Sigma = \{0, 1\}$

1/ Scan the input from left to right till the end of the tape, whether the combined string w and w^R is odd or even in length. If it is good, then reject it.
         Else, move to stage 2

2/ Read the first charact read in, replace it with an X to mark the position. Then, move the head to the right until the end of the tape and read the last character of the combined strings. If it matches with the first character, then mark it with an X as we did, then move the head to the left until it meets X, then make the head read the character next to the right of X, then move the head to the right until it reaches X, read the character next to the left of X. If it matches with the last marked character, repeat stage 2 till the combined strings² becomes all X's, the move to stage 3. If any of them does not match, reject it.

3/ Accept it to finalize.