

BRAC UNIVERSITY
CSE331 : Automata and Computability
Summer 2025

Duration: 30 minutes

Quiz 5

Total: 20 marks

Name:

ID:

0.5 Points

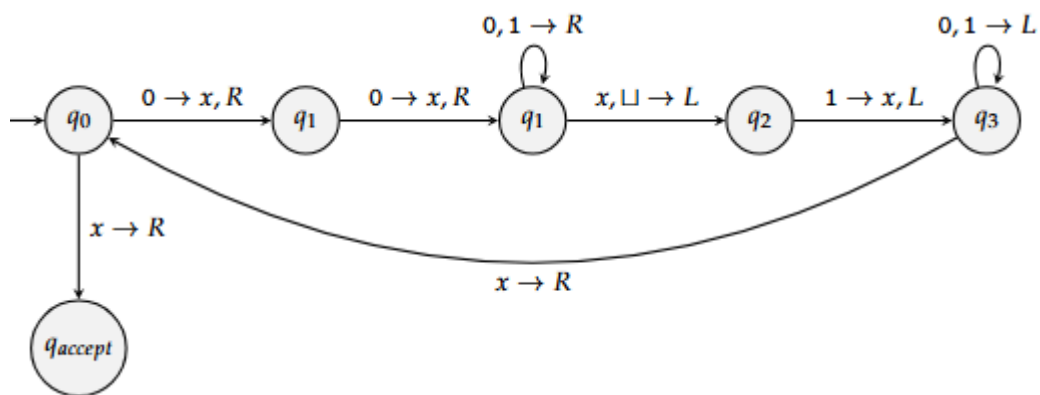
Section:

0.5 Points

Turing Machines

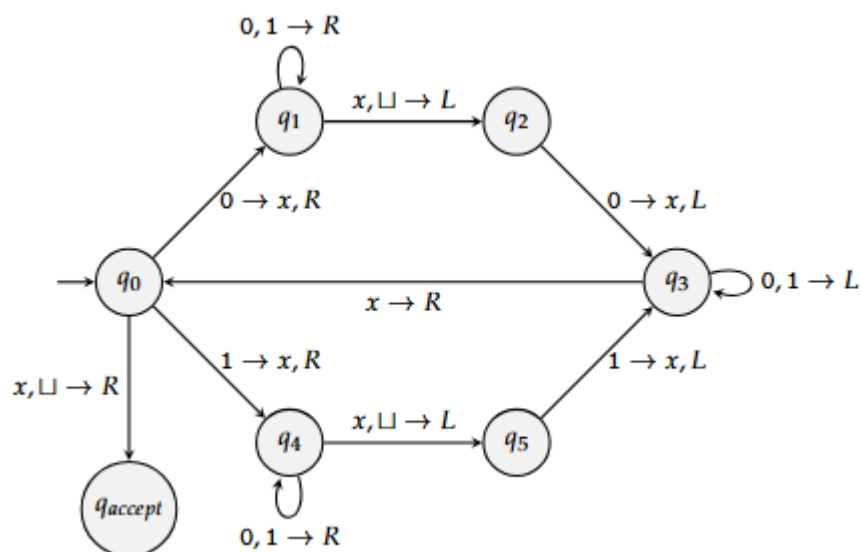
1. Let, $L_1 \rightarrow \{w = 0^n 1^m \mid n, m > 0 \text{ and } n = 2m\}$, where $\Sigma = \{0, 1\}$. Draw the state diagram of a TM that decides L_1 . (5 points)

Solution:



2. Let, $L_2 \rightarrow \{w \in \Sigma^* \mid w \text{ is an even length palindrome}\}$, where $\Sigma = \{0, 1\}$. Draw the state diagram of a TM that decides L_2 . (6 points)

Solution:



3. Write the current state and current head position of a TM in a configuration 010q₆10. (2 points)
Answer: q₆, 4th symbol.

5. Let, $A_{CORE} \rightarrow \{\langle R, w \rangle \mid R \text{ is a regular expression that does not generate the string } w\}$.

Prove that A_{CORE} is decidable. (6 points)

Solution: M = “On input $\langle R, w \rangle$:

1. Convert regular expression R to an equivalent NFA N using Thompson's construction method.
2. Convert NFA N to an equivalent DFA D using subset construction method.
3. Simulate D on input w.
4. If D accepts, reject; otherwise accept.”

Since the simulation always ends after $|w|$ steps, M is a decider.

Bonus

1. Let, $A_{TM} \rightarrow \{\langle M, w \rangle \mid M \text{ is a TM that accepts } w\}$. Prove that A_{TM} is undecidable. (2 points)

Solution: