UNIT-III

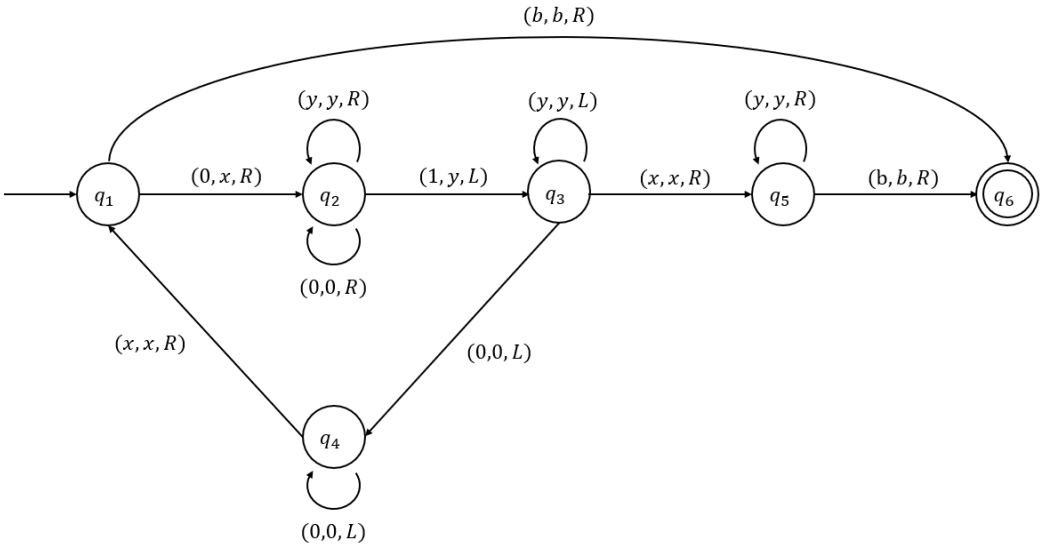
PRACTICE QUESTIONS

1. Explain the Turing Machine model with the help of diagram.
2. Write a short note on Representation of a Turing Machine by Instantaneous Descriptions.
3. Write a short note on Representation of a Turing Machine by Transition Table.
4. Discuss the following construction techniques of Turing Machines
    a. Turing machine with stationary head
    b. Storage in the State
    c. Multiple Track Turing Machine
    d. Subroutines
5. Write a short note on Multitape Turing Machine.
6. Explain Linear Bound Automata with the help of diagram.
7. Write a short note on Church-Turing Thesis
8. Differentiate between Turing Machine and Universal Turing Machine.
9. Consider the Turing Machine represented by the following Transition Table. Show processing of the string 00.

Present State	Tape Symbols		
	0	1	b
$\rightarrow q_1$	$(0, q_1, R)$		$(1, q_2, L)$
q_2	$(0, q_2, L)$	$(1, q_2, L)$	(b, q_3, R)
q_3	(b, q_4, R)	(b, q_5, R)	
q_4	$(0, q_4, R)$	$(1, q_4, R)$	$(0, q_5, R)$
(q_5)			$(0, q_2, L)$

10. Consider a Turing Machine represented by the following Transition Diagram.

    Obtain computing sequence of M for the input string 0011.



11. Consider the Turing Machine represented by the following Transition Table. Process the following strings using IDs. Also, mention whether the strings are accepted by M or not.
    a. 011
    b. 0011
    c. 001

Present State	Tape Symbols		
	0	1	b
$\rightarrow q_1$	$(0, q_1, R)$		$(1, q_2, L)$
q_2	$(0, q_2, L)$	$(1, q_2, L)$	(b, q_3, R)
q_3	(b, q_4, R)	(b, q_5, R)	
q_4	$(0, q_4, R)$	$(1, q_4, R)$	$(0, q_5, R)$
(q_5)			$(0, q_2, L)$

12. Design a Turing Machine to recognize all strings consisting of even number of 1's.

Answer :

The construction is made by defining the moves in the following manner :

(a) q_1 is the initial state. M enters the state q_2 on scanning 1 and writes 'b'.

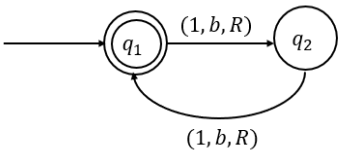
(b) If M is in state q_2 and scans 1, it enters q_1, and writes 'b'.

(c) q_1 is the only accepting state.

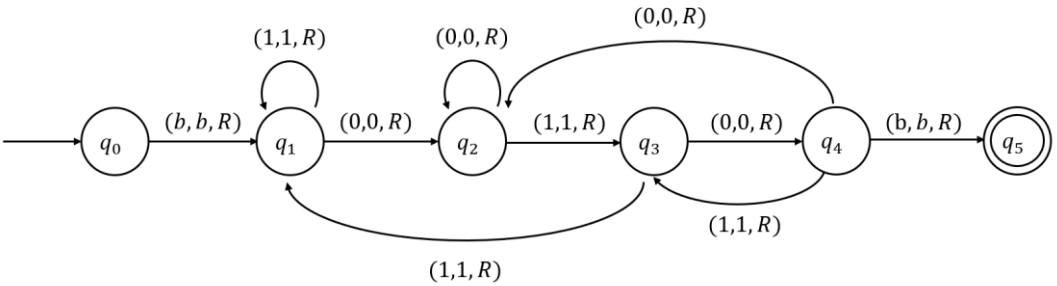
So, M accepts a string if it exhausts all the inputs symbols and finally is in state q_1.

Symbolically, $M = (\{q_1, q_2\}, \{1, b\}, \{1, b\}, \delta, q_1, b, \{q_1\})$ where δ is given by the following Transition Table.

	Present State	1
→	q_1	(b, q_2, R)
	q_2	(b, q_1, R)



13. Design a Turing Machine which recognizes the language $\{0^n1^n | n \geq 1\}$. Also, show processing of the strings 0011 and 010.
14. Design a Turing Machine which recognizes the language $\{1^n2^n3^n | n \geq 1\}$.
15. Design a Turing Machine which accepts the set L of all strings over {0,1} ending with 010.



Present State	Tape Symbols		
	0	1	b
$\rightarrow q_0$			(b, q_1, R)
q_1	$(0, q_2, R)$	$(1, q_1, R)$	
q_2	$(0, q_2, R)$	$(1, q_3, R)$	
q_3	$(0, q_4, R)$	$(1, q_1, R)$	
q_4	$(0, q_2, R)$	$(1, q_3, R)$	(b, q_5, R)
$* q_5$			

16. Define :
    a. Procedure
    b. Algorithm
    c. Recursive Set
    d. Recursively Enumerable Set
    e. Recursively Enumerable Language

f. Decidable Problem/Language

g. Undecidable Problem/Language

17. Define : Turing Machine.

18. Define : Non Deterministic Turing Machines.

19. Define : Recursive Language

20. Write a short note on Representation of a Turing Machine by Transition Diagram.

21. What is Halting Problem?

22. Draw the Transition Diagram for the Turing Machine represented by the following Transition Table.

Present State	Tape Symbols		
	0	1	b
$\rightarrow q_1$	$(0, q_1, R)$		$(1, q_2, L)$
q_2	$(0, q_2, L)$	$(1, q_2, L)$	(b, q_3, R)
q_3	(b, q_4, R)	(b, q_5, R)	
q_4	$(0, q_4, R)$	$(1, q_4, R)$	$(0, q_5, R)$
q_5			$(0, q_2, L)$

23. Consider a Turing Machine represented by the following Transition Diagram.

Write the Transition Table for the Turing Machine.