Branch : CSE & IT   Batch : Hinglish

Theory of Computation
Turing Machine Recursively Enumerable Turing Machine-2

DPP 02

[MCQ]

1. Which of the following statement is correct?

   (a) Every NTM (Non-deterministic Turing Machine) can be converted into DTM (Deterministic Turing Machine).

   (b) Every DTM (Deterministic Turing Machine) can be converted into NTM (Non-deterministic Turing Machine).

   (c) Both (a) and (b)

   (d) None of these

[MSQ]

2. Which of the following statement is/are true regarding halting of turing machine?

   (a) If head of TM always move right, then TM never halts.

   (b) If head of TM always move left, then TM may halt.

   (c) If head of TM always move left, then TM never halts.

   (d) If head of TM moves in right and sometimes in left (loop), then also the never halts.

[MCQ]

3. Given transition table of turing machine is as follow:

	0	1
→ q_0	q_0, 0, R	q_1, 0, R
q_1	q_0, 1, R	q_1, 1, R

   If q_0 is initial state and q_1 is final state, which of the following language is accepted by given turing machine?

   (a) Set of all string ending with 1.

   (b) Set of all string ending with 11.

   (c) Set of all string starting with 0.

   (d) Set of all string starting with 10.

[MSQ]

4. Which of the following is/are true?

   (a) There exist no recursive enumerable language that is recursive language.

   (b) If L is CFL, then complement of L may be CFL.

   (c) There exist no recursive language that is not recursively enumerable.

   (d) If L is CFL, then complement of L may be CSL.

[MSQ]

5. Which of the following has the same computational power as of turing machine?

   (a) PDA with additional 2 stack.

   (b) PDA with additional 1 stack.

   (c) FA with additional 1 counter.

   (d) FA with additional 2 counter.

[MCQ]

6. Which of the following is a correct transition function of DTM?

   When

   Q = Set of state

   Σ = Input alphabet

   Γ = Tape alphabet

   F = Final state

   δ = Transition function

   (a) $\delta : Q \times \Sigma \rightarrow Q \times \Gamma \times F$

   (b) $\delta : Q \times \Sigma \rightarrow Q \times \Sigma \times \{L, R\}$

   (c) $\delta : Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R\}$

   (d) $\delta : Q \times \Gamma \rightarrow Q \times \Sigma \times F$
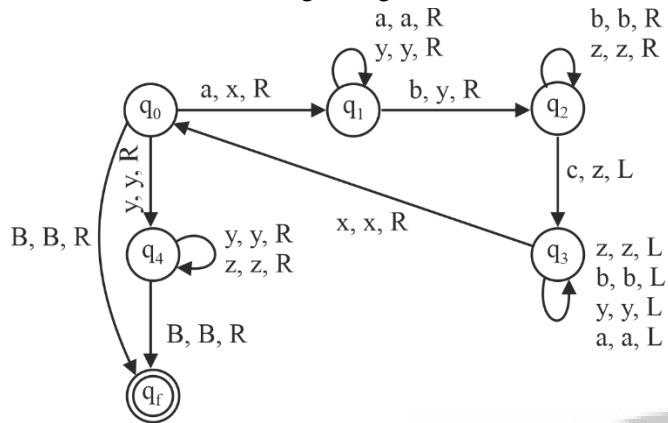
[NAT]

7. How many of the following languages are context sensitive language?

   (i) $L = \{a^{n^2} \mid n \geq 0\}$

   (ii) $L = \{a^n b^m c^n d^m \mid n, m \geq 0\}$

   (iii) $L = \{a^n b^m c^m d^n e^f \mid n, m, f \geq 0\}$

(iv) $L = \{wx\, w^R \mid x, w \in (0, 1)^*\}$

(v) $L = \{a^n\, b^{n^2} \mid n \geq 0\}$

[MCQ]

8. Consider the following turing machine:

Which of the following language is accepted by given turing machine?

(a) $\{L = \{a^m\, b^n\, c^p \mid m, n, p \geq 0\}$

(b) $\{L = \{a^m\, b^n\, c^p \mid m, n \geq 0\}$

(c) $\{L = \{a^m\, b^m\, c^m \mid m \geq 0\}$

(d) $\{L = \{a^m\, b^{2m}\, c^{3m} \mid m \geq 0\}$

Answer Key

1. (c)
2. (a, c, d)
3. (a)
4. (c, d)

5. (a, b, d)
6. (c)
7. (3)
8. (c)

Hints & Solutions

1. **(c)**

Every DTM can be converted into NTM and every NTM can be converted into DTM.
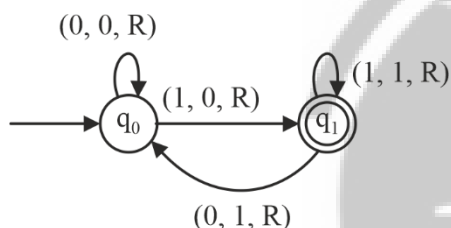
DTM $\cong$ NTM

2. **(a, c, d)**

(a) If head of TM always move right, then TM never halts.

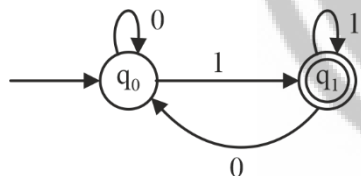(c) If head of TM always move left, then TM never halts.

(d) If head of TM moves in right and sometimes in left (loop), then also the never halts.

Those three statements are true.

3. **(a)**

This turing machine is equivalent to following finite automata.

Language accepted by the given turing machine:

$(0 + 1)^* 1$

4. **(c, d)**

Recursive language subsets of REL's. Therefore, option (a) is false and option (c) is true.

All recursive language are recursive enumerable languages.

CFL's are not closed under complementation. Therefore, option (b) is false and option (d) is true.

5. **(a, b, d)**

PDA with additional 2 stack and PDA with 1 stack and FA with 2 counter has the same computational power as of turing machine.

Therefore, option (a), (b) and (d) are correct.

6. **(c)**

Transition function for DTM is defined as:

$Q \times \Gamma \to Q \times \Gamma \times \{L, R\}$

So, option (c) is correct.

7. **(c)**

(i) $L = \{a^{n^2} \mid n \geq 0\}$. This is CSL

(ii) $L = \{a^n b^m c^n d^m \mid n, m \geq 0\}$. This CSL

(iii) $L = \{a^n b^m c^m d^n e^f \mid n, m, f \geq 0\}$. This is DCFL

(iv) $L = \{wx w^R \mid x, w \in (0, 1)^*\}$. This is regular

(v) $L = \{a^n b^{n^2} \mid n \geq 0\}$. This is CSL.

So, (i), (ii), and (v) are CSL.

8. **(c)**

The given turing machine accepts such as

$\{\in, abc, aabbcc, aaabbbccc, ...\}$.

Therefore, $L = \{a^m b^m c^m \mid m \geq 0\}$ is correct answer.