Branch : CSE & IT Batch:Hinglish

WEEKLY TEST – 05
Subject : Theory of Computation

Maximum Marks 15

Q.1 to 5 Carry ONE Mark Each

1. [MCQ]
Consider the following language:
$L_1 = a^n b^n c^*$
$L_2 = a^* b^n c^n$
If $L = L_1 \cap L_2$
Which of the following is correct about L?
(a) CFL not DCFL
(b) CFL
(c) CSL not CFL
(d) None of these

2. [MCQ]
Consider the following statements, which of the following is true?
(a) Intersection of DCFL with CFL are CFL.
(b) Intersection of CFL with CFL need not to be CFL.
(c) Intersection of set of all CFL's with set of all regular is always DCFL.
(d) Intersection of infinite language with CFL need to be CFL.

3. [MCQ]
What does the following transition means:
$\delta(q, b) = \delta(q' W,R)$
(a) Read W, write w, Move Right
(b) Read b, write W, Move Right
(c) Read W, Read b, Move Right
(d) Read b, Read b, Move Right

4. [MSQ]
Which of the following statement is/are correct?
(a) Turing machine always halt for valid strings
(b) Turing machine may halt for invalid strings
(c) Turing machine accepts recursively enumerable language
(d) Halting Turing machine accepts recursively enumerable language

5. [NAT]
Consider the following grammar.
$S \rightarrow ABCS|E$
$A \rightarrow a$
$B \rightarrow b$
$C \rightarrow c$
Total number of states in minimal DFA of above grammar is_____.

Q.6 to 10 Carry TWO Marks Each

6. [MCQ]
Consider the following statements:
(i) $L_1 = \{xyx^R \mid x \in (0,1)^+, y \in (0,1)^*\}$ is regular.
(ii) There exists a language that is recursively enumerable but Not REC.
Which of the following is correct?
(a) Only (i) is correct
(b) Only (ii) is correct
(c) Both (i) & (ii) are correct
(d) None of these

7. [MCQ]
Which of the following is Turing acceptable?
(a) Set of real numbers.
(b) Set of real number between 0 and 1
(c) Set of prime numbers
(d) All of the above.

8. [MSQ]

Which of the following are equivalent to Turing Machine?

(a) Universal Turing Machine.
(b) Multi-stack PDA
(c) Finite Automata with two Stack
(d) Finite Automata with read/write tape and bidirectional head.

9. [NAT]

How many statements are correct from the following?

(i) If TM head is unidirectional then language accepted by TM is regular.
(ii) If TM always halts then L(TM) is recursive language.
(iii) If TM always halt and uses linear bound tape then L(TM) is recursively enumerable.

10. [MCQ]

Which of the following is false?

(a) Union of two recursive language is recursive.
(b) Intersection of regular and recursive language is recursive.
(c) Union of regular and recursive is recursive.
(d) None of these.

Answer Key

1.	(c)
2.	(b)
3.	(b)
4.	(a, b, c)
5.	(7)
6.	(c)
7.	(c)
8.	(a, b, c, d)
9.	(2)
10.	(d)

Hint & Solutions

1. (c)

Given:

$L_1 = a^n b^n c^*$

$L_2 = a^* b^n c^n$

$L_1 \cap L_2 = a^n b^n c^n$

$L = a^n b^n c^n$, this is CSL but not CFL.

$\therefore$ Option 'C' is correct.

2. (b)

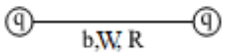
(a) CFL $\cap$ DFCL = may or may not be CFL. [so false]

(b) CFL $\cap$ CFL = need not to be CFL. [so true]

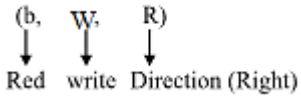
(c) Set of all CFL's $\cap$ set of all regular's = set of all regular [So, false]

(d) CFL $\cap$ infinte langauge = Need not to be CFL. [So false]

3. (b)



Read b, write W and more to right direction.



4. (a,b,c)

(a) Turing machine always halt for valid strings.

(b) Turing machine may halt for invalid strings.

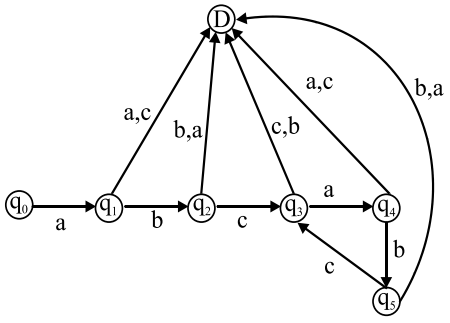
(c) Turing machine accepts recursively enumerable language.

(d) Halting Turing machine accepts recursively enumerable language, HTM accepts recursive language.

5. (7)

The minimal DFA for the above grammar is as follows:

The language generated by given grammar is Lz {$\in$, abc, abcabc, ……}.



Total 7, states are required.

6. (c)

(i) $L_1 = \{xyx^R \mid x \in (0,1)^+, y \in (0,1)^*\}$ is regular.

(ii) There exists a language that is recursively enumerable but Not REC.

Both statements are correct. So option C is correct.

7. (c)

Set of real number between 0 and 1 are uncountable and not turing are acceptable.

Set of prime number are decidable and acceptable by turing machine.

8. (a, b, c, d)

(a) Universal Turing Machine.

(b) Multi-stack PDA

(c) Finite Automata with two Stack

(d) Finite Automata with read/write tape and bidirectional head.

(a), (b), (c), (d) all are equivalent to Turing machine.

9. (2)

(i) If TM head is unidirectional then language accepted by TM is regular.

(ii) If TM always halts then L(TM) is recursive language.

Only these 2 statements are true.

If TM always halts and uses linear bound tape then L(TM) is CSL. So, (iii) is false.

10. (d)

Recursive $\cup$ Recursive = Recursive

Regular $\cap$ Recursive = Recursive

Regular $\cup$ Recursive = Recursive

$\therefore$ D is correct.