Branch : CSE & IT | Batch : Hinglish

Theory of Computation

Undecidability & Decidability III

DPP 03

[MCQ]

1. Which of the following is correct about tuples of Turing machine?

(a) $\sum \subseteq \Gamma$

(b) $\sum = \Gamma$

(c) $\sum \subseteq \Gamma - \{B/\square\}$

(d) $\sum = \Gamma - \{B/\square\}$

[MSQ]

2. Which of the following is/are equivalent to recursive language?

(a) Turing machine decidable language.

(b) Acceptable by halting Turing machine.

(c) Decidable language.

(d) Lexicographically enumerable.

[MCQ]

3. Which of the following is undecidable?

(a) Set of all regular language.

(b) Set of DCFL language.

(c) Set of finite language.

(d) None of these.

[NAT]

4. Consider the following statements:

(a) Every recursive language is countable.

(b) Every recursive enumerable language is countable.

(c) There exist a countable set which is not regular.

(d) Set of all recursive enumerable languages is countable.

Total number of incorrect statements are _____.

[MCQ]

5. Which of the following is semidecidable but undecidable for recursive language?

(a) Finiteness (b) Totality

(c) Halting (d) Non-totality

[MSQ]

6. Suppose, $P \leq Q$ means P is reducible to Q. Which of the following is/are correct?

(a) If P is decidable then Q is decidable.

(b) If Q is decidable in $(P)^C$ is decidable.

(c) If Q is undecidable then P may be decidable.

(d) If P is undecidable then Q is undecidable.

[MCQ]

7. Which of the following is incorrect?

(a) Every countable set is semi decidable.

(b) Every decidable is countable.

(c) Set of all DCFLs is countable

(d) None of these.

Answer Key

1. **(c)**
2. **(a, b, c, d)**
3. **(d)**
4. **(0)**
5. **(d)**
6. **(b, c, d)**
7. **(a)**

Hint & Solutions

1. (c)

Tuples of Turing machine:

$(Q, \sum, \Gamma, \delta, q_0, B/\square, F)$

Q = Set of all states
$\sum$ = Input alphabet
Γ = Tape alphabet
δ = Transition function
q_0 = Initial state
$B/\square$ = Blank
F = Final state

- Γ may be {a, b, 0, 1, □, etc}
- $\sum$ can be {a, b}
  $\sum \subseteq \Gamma - \{ B/\square \}$
  Hence, option (c) is correct.

2. (a, b, c, d)

All are synonyms of recursive language.
Hence, all are correct.

3. (d)

Set of all language like, DCFLs, CFLs, CSLs, regular etc all are undecidable (RE but not recursive)
Hence, option (d) is correct.

4. (0)

- If language is recursive then it will be RE also and every RE is countable.
  Recursive → RE → Countable
- Set of all finite sets, regular, CFLs, CSLs, recursive, RELs all are RE but not recursive. And every RE is countable.
  All statements are correct.
  Incorrect statement = 0.

5. (d)

Non-Totality, non-equivalence, non-disjointness, Non-set containment all are RE but not recursive (SD but UD).

6. (b, c, d)

$P \leq Q$

- If P is decidable then Q may/may not be decidable.
- If P is UD then Q is UD.
- If Q is decidable then P is decidable.
- If Q is UD then P may/may not be UD.

7. (a)

Every semidecidable (RE) is countable but vice-versa not true.
Hence, option (a) is incorrect.