

CS & IT ENGINEERING

Discussion Notes

Theory of Computation



Decidability

DPP 02



Mallesham Devasane Sir

TOPICS TO BE COVERED

01 Question

02 Discussion

Q.1



Let $L = \{(X) \mid X \text{ is a DFA and } L(X) \text{ is an infinite language}\}$; where (X) represents the illustration of the deterministic finite automata (DFA).

[MSQ]

Then which of the statement is/are correct?

- A. It is recognizable by Turing. ✓
- B. Its complement is recognizable by Turing. ✓
- C. It is Turing decidable (recursive). ✓
- D. It is context-free but not regular.

Q.2

Which of the following statement is/are incorrect?

[MSQ]



Incorrect
A.

If L is CFL and A is DCFL then $L-A$ is CFL.

$$CFL - DCFL = CFL \cap \overline{DCFL} \Rightarrow CFL \cap DCFL \Rightarrow CSL$$

Incorrect
B.

The subset of a decidable language is always decidable.

Incorrect
C.

If L and A are DCFL then $(\bar{L} \cap \bar{A})$ is CFL.

D.

None of the above are incorrect.

Q.3

Consider some language $P \in \{0,1\}^*$ reduces to another language $Q \in \{0,1\}^*$. Which of the following statement is true?

[MCQ]



$$P \leq Q$$

A.

P is decidable. \times

B.

A Turing machine that recognizes P can be used to construct a Turing machine that recognizes Q. \times

C.

If Q is decidable then P is decidable. \checkmark

D.

If P is decidable then Q is decidable. \times

Q.4

[MCQ]



Consider the following statement:

S_1 : In phrase structured language, membership problem is semi decidable. *True*

S_2 : In context-free languages, membership problem can be solved in polynomial time. *True $O(n^3)$*

A.

Only S_1 is true

B.

Only S_2 is true

☒ C.

Both S_1 and S_2 is true

D.

Neither S_1 nor S_2 is true

Q.5

[MCQ]



Consider the following statements:

S_1 : For a decidable language X , X^R may or may not be decidable.

(X^R represents the reverse of language X). *false*

S_2 : If X is not recursively enumerable then \bar{X} must be recursively enumerable. *false*

- A. Only S_1 is true
- B. Only S_2 is true
- ☒ C. Both S_1 & S_2 are false
- D. Both S_1 & S_2 are true

Q.6

Consider the following statements about Turing machine.

[MCQ]



S_1 : If there is some Turing machine that accepts every string in L and rejects every string not in L then L is decidable. ✓

S_2 : If there is some Turing machine that accepts every string in L and either rejects or loops on every string not in L , then L is semi-decidable or computably enumerable (CE). ✓

A.

Only S_1 is true

B.

Only S_2 is true

☒ C.

Both S_1 & S_2 are true

D.

Neither S_1 nor S_2 is true

Q.7

Which of the following is/are decidable properties of context-free?



[MSQ]

A.

for context-free grammar X , find if string $w \in L(X)$

B.

for context-free grammar X , find if $L(X) = \phi$.

C.

for context-free grammar X , find if $L(X)$ is infinite.

D.

none of the above are decidable properties of context free.

Q.8

[MCQ]



Consider the following statements:

S_1 : There is language for which no TM available. Then surely language will be Not RE. *correct*

S_2 : Language is undecidable if and only there is no HTM available for language. *correct*

Which of the following is incorrect?

A.

S_1 only.

B.

S_2 only.

C.

Both S_1 and S_2 .

☒ D.

Neither S_1 Nor S_2 .

