Class Notes

CS & IT ENGINEERING

Theory of Computation

Turing Machine
Undecidability

DPP_01

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[MCQ]

#Q. Consider the following two regular expressions R_1 and R_2 over $\Sigma = \{a,b\}$.

$R_1 = a^* (ba^*)^*$

$R_2 = (a^* + b^*)^*$

Which of the following is true?

A $R_1 \subset R_2$

B $R_2 \subset R_1$

C $R_1 = R_2$

D $R_1 \cap R_2 = a^*b^*$

[NAT]

#Q. Consider the following statements:

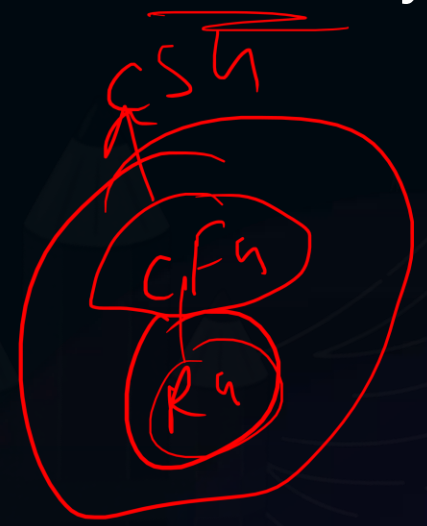
I. A regular grammar can generate some CFL language.

II. There are some non-regular language for which PDA not exist.

III. Context sensitive grammar exists for every CFL.

IV. If L is a regular and M is not a regular language then L.M is necessarily not regular.

Number of correct statement is/are _____?



[MSQ]

#Q. Which of the following languages are not decidable?

A $L = \{<G> \mid G \text{ is CFG and R is a regular set such that } L(G) = R\}$

B $L = \{<G> \mid G \text{ is CFG such that } L(G) = \phi\}$

C $L = \{<G_1, G_2> \mid G_i \text{ is CFG such that } L(G_1) \cap L(G_2) = \Sigma^*\}$

D $L = \{< G_1, G_2>\} \mid G_i \text{ is CFG such that } L(G_1) = L(G_2)\}$

[NAT]

#Q. Consider the following problems:

P_1: Does a given program ever produce an output?

P_2: Given DFAs D_1 and D_2 is $L(D_1) \cap L(D_2) = \phi$?

P_2: For Context sensitive grammar G and string w, is $w \in L(G)$?

How many languages is/are Undecidable? ____.

[MCQ]

#Q. If $L_1 \cap L_2$ is regular and L_1 is non-regular then, L_2 must be

$L_1 \cap L_2 = Reg$

$NR \cap L_2 = Reg$

$\{a^n b^n\} \cap \phi = \phi$ (0)

$a = Reg$

$ab = Reg$

(A) Regular but not finite ✗

(B) Non-regular ✗

(C) Finite ✗

(D) None of these ✓

$\{a^n b^n \mid n \geq 0\} \cap \{a^n b^n \mid n \geq 0\}$

$L_1 \qquad \phi$

[MSQ]

$P_1 \leq P_2$

#Q. If P_1 is reducible to P_2 then, which of the following is/are correct?

A. If P_1 is decidable then, P_2 is undecidable. we can't say ✗

B. If P_2 is undecidable then, P_1 is decidable. ✗

C. If P_2 is decidable then, P_1 must be decidable. ✓

D. If P_1 is undecidable then, P_2 must be undecidable. ✓

[MSQ]

#Q. Let,

L_1 = CFL

L_2 = DCFL

L_3 = Regular

Then, which of the following is/are correct?

B, D

$L_1 - L_2 = L_1 \cap \overline{L_2}$

$a^n b^n \cdot \phi = R$

$a^n b^n \cdot c$ = DCFL

A $L_3 - L_1$ is CSL $\Rightarrow Reg \cap \overline{CFL} \Rightarrow Reg \cap CSL \Rightarrow CSL$

B $L_1 \cup (L_2 \cap \overline{L_3})$ is CFL $\Rightarrow CFL \cup (DCFL \cap \overline{Reg}^{Reg}) = CFL \cup DCFL = CFL$

C $L_2 \cdot L_3$ is Regular $= DCFL \cdot Reg = X$

D $L_2 \cup L_3$ is DCFL $DCFL \cup Reg = DCFL$

[NAT]

#Q. Consider the following statements:

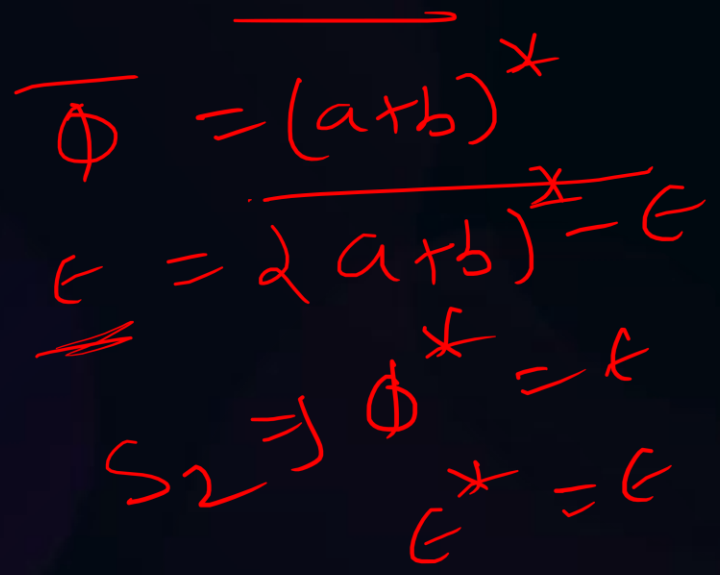
S1: Complement of finite language may be finite.

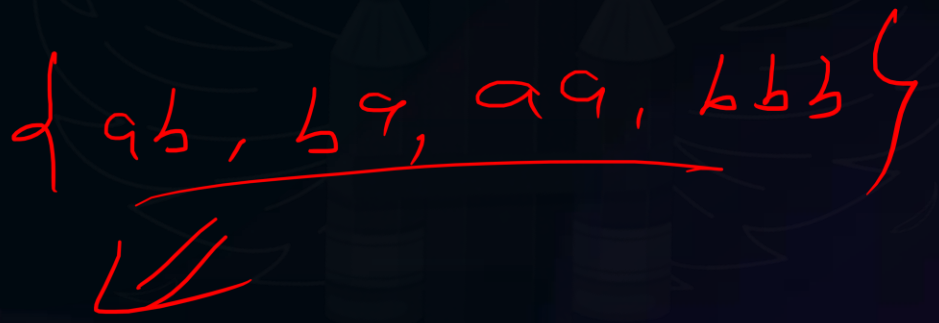
S2: Kleene star of finite language may be finite.

S3: Subset of finite language is always finite.

S4: Complement of infinite language may be finite.

Number of INCORRECT statements is/are_____.





[MSQ]

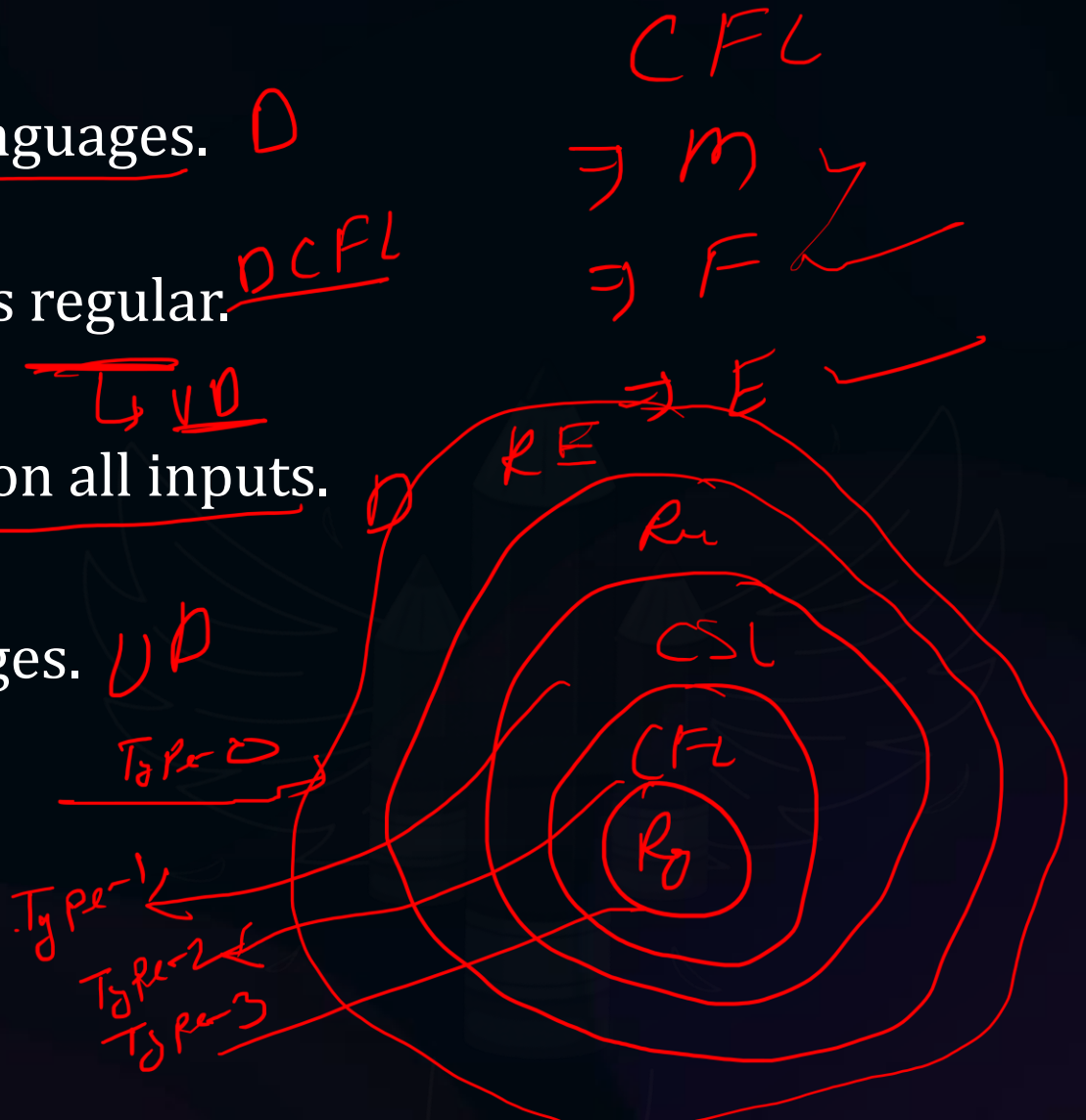
#Q. Which of the following problems are undecidable?

A. Membership problem in context-free languages.

B. Whether a given context-free language is regular.

C. Whether a finite state automation halts on all inputs.

D. Membership problem for type-0 languages.



[MCQ]

#Q. Which one of the following is UNDECIDABLE?

A. Given a Turing machine M, a stings 's' and an integer k, M accepts s within k steps

B. Equivalence of two given Turing machines

C. Language accepted by a given finite state machine is not empty

D. Language generated by a context free grammar is non empty

[MCQ]

#Q. Consider the following decision problems:

(P_1) Does a given finite state machine accept a given string?

(P_2) Does a given context free grammar generate an infinite number of strings

Which of the following statements is true?

A Both (P_1) and (P_2) are decidable

B Neither (P_1) nor (P_2) are decidable

C Only (P_1) is decidable

D Only (P_2) is decidable

[MCQ]

#Q. Which of the following problems is undecidable?

CFL R CSL

E ✓ X

M ✓ ✓

E ✓ X

A Membership problem for CFGs. Dec

B Ambiguity problem for CFGs. UD

C Finiteness problem for FSAs. Dec

D Equivalence problem for FSAs. Dec

[MSQ]

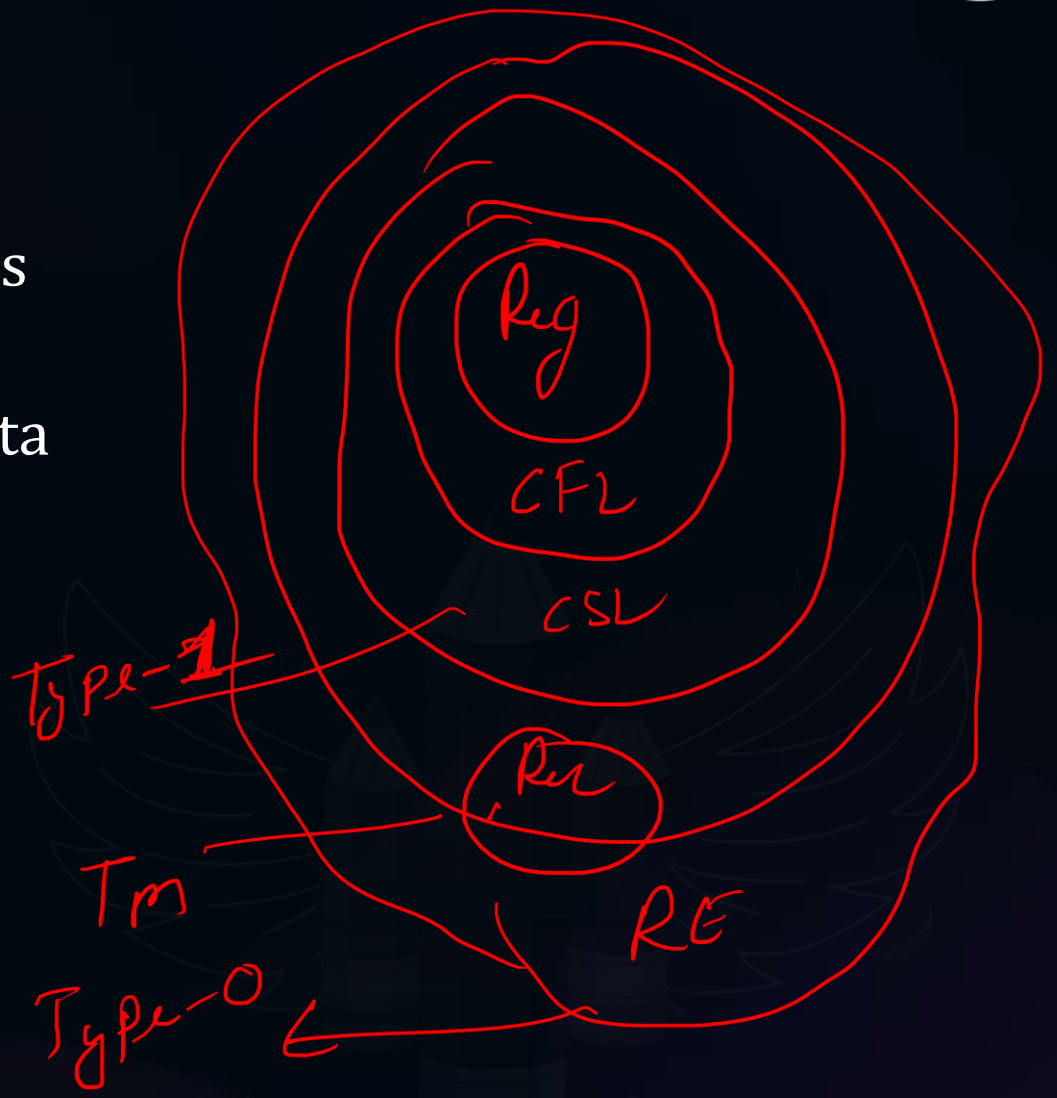
#Q. Recursive languages are:

A. a proper superset of context free languages

B. always recognized by a pushdown automata

C. also called type-0 languages

D. recognizable by Turing machines



Classes Over

Telegram

SWT ⇒ 50-60 problems

3DPP ⇒ 40-50 problems

⇒ 100 problem

CN ⇒ 200 problems

THANK - YOU

300

250 PYQ

550

Reg → 60% (Closure properties) 50%

4-6

CFG → 25-30%

2-4

DFA → RE, RS

TM ⇒ 1 2marks