CS & IT Engineering

Deva sir

Topics to be covered:

↳ practice on undecidability

Topics Covered in Previous Session:

- Undecidability Problems ↔ languages

1. Which of the following is decidable ?

A. Finite Language ⇒ Decidable language (Recursive)
B. Regular Language
C. Context Free Language
D. All of the above

MCQ

2. Which of the following is decidable ?

A. Complement of a Regular Language
B. Complement of a Context Free Language
C. Both A and B
D. None of these

⇒ Regular ⇒ Decidable

⇒ CSL

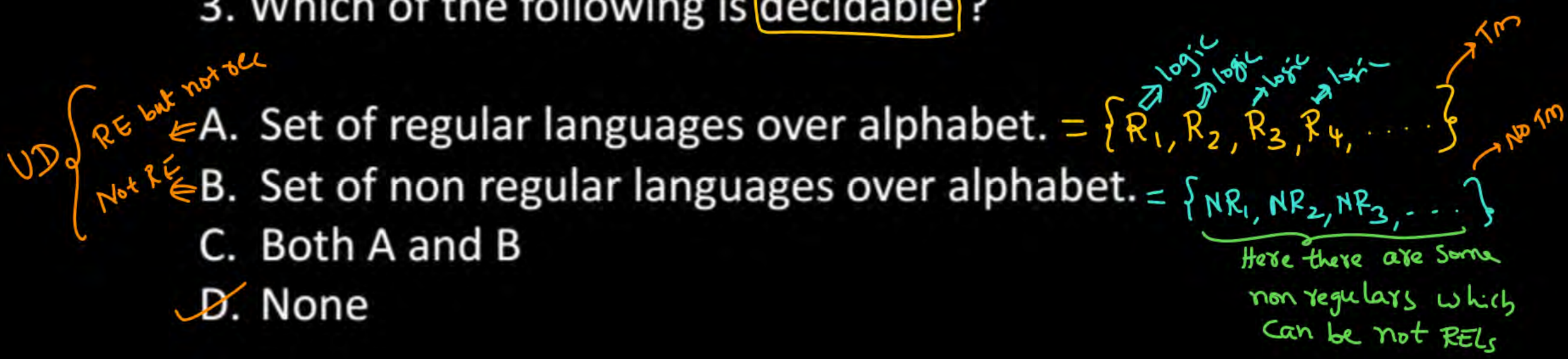
3. Which of the following is decidable ?

A. Set of regular languages over alphabet.

B. Set of non regular languages over alphabet.

C. Both A and B

D. None



4. Which of the following is uncountable ?

A. $\Sigma = \{a, b\}$.
B. Σ^* over $\Sigma = \{a, b\}$.
C. 2^{Σ^*} over $\Sigma = \{a, b\}$.
D. None

Countable

A. $\Sigma = \{a, b\}$. → finite

B. Σ^* over $\Sigma = \{a, b\}$. → Regular

C. 2^{Σ^*} over $\Sigma = \{a, b\}$. → set of all languages

5. Which of the following is undecidable ?

A. $\Sigma = \{a, b\}$. → fin → Dec → Reg

B. Σ^* over $\Sigma = \{a, b\}$.

C. 2^{Σ^*} over $\Sigma = \{a, b\}$. = Set of all languages ⇒ Not REL

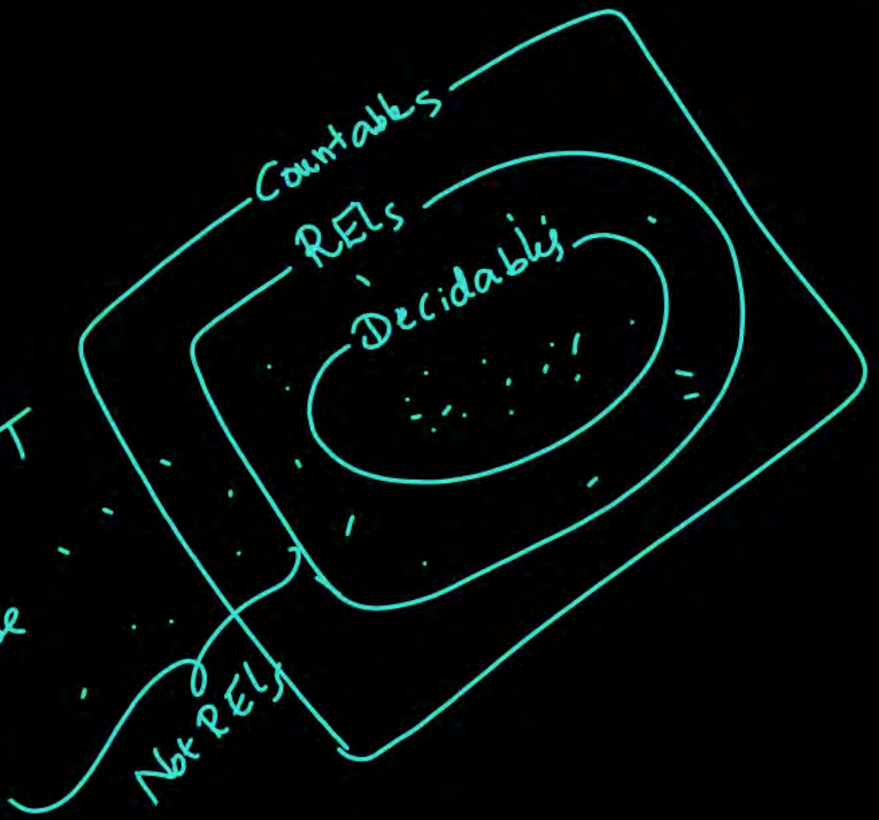
D. None

6. Which of the following is decidable ?

A. Set of all symbols. → finite → Decidable
B. Set of all strings over finite alphabet. = Σ^* → Yes → Decidable
C. Set of all languages over finite alphabet. → Undecidable, Not RE
D. Both A and B

7. Which of the following is FALSE?

A. Every decidable set is countable set. T
B. Every REL is countable set. T
C. Every Non-REL is uncountable set. False
D. None of these



8. Let L = { M | M is a DFA that accepts ab }. Then L is _____

Membership

A. Decidable Language
B. REL but not recursive
C. Not REL
D. None of these

L = Set of DFAs accepting ab

$= \{M_1, M_2, M_3, \ldots\}$

9. “Whether given DFA accepts ab“ is _____

A. Decidable Language
B. REL but not recursive
C. Not REL
D. None of these

10. Let L = { M | M is a DFA that halts on ab }. Then L is _____

Halting

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C

L = Set of all DFAs halts on ab

= Set of all DFAs

11. Let L = { R | R is regular language over alphabet}. Then L is _____

L = Set of all regular languages

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C

$\bar{L}$ = Set of all non regulars

12. Let L = { R | R is a regular expression that generates string w}.

L = Set of all regular expressions generating w.

Then L is _____

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C

13. Let L = { R | R is a regular grammar that generates string w}.

L = Set of RG, generating w.

Then L is _____

A. Decidable Language ✓
B. Undecidable Language
C. Regular Language
D. Both A and C

14. Let L = { M | M is a DPDA that accepts string w}.

= Set of all DPDAs accepting w

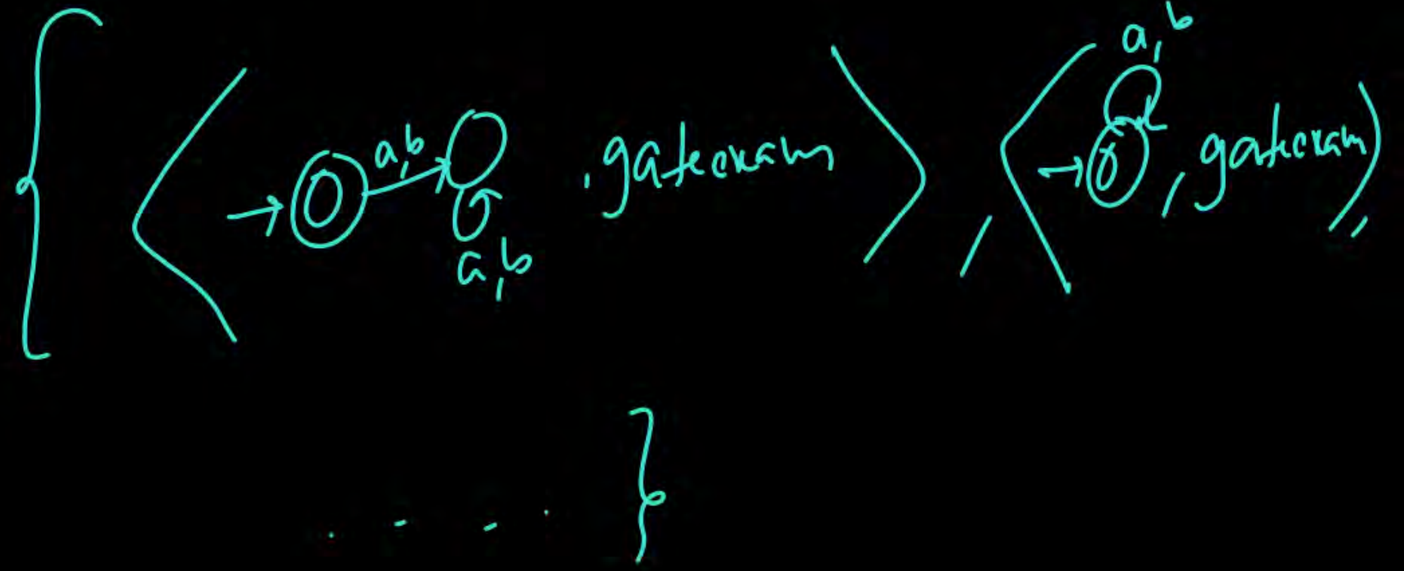
Then L is _____

A. Decidable Language ✓
B. Undecidable Language
C. Regular Language
D. Both A and C

= Set of all pairs where DFA accepts ε

15. Let L = { <DFA, gateexam> | DFA accepts string epsilon}.
Then L is _____

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C



16. Let L = { DFA | DFA accepts finite language}.
Then L is _____

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C

17. Let L = { DPDA | DPDA accepts infinite language}.
Then L is _____

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C

18. Let L = { <F, R> | F is FA and R is Regular Expression, L(F)=L(R)}.
Then L is _____

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C

19. Let L = { <FA, DPDA> | L(FA)=L(DPDA)}. Then L is _____

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C

20. Let L = { w | w belongs to {a, b}*, w starts with a}.

$= \{a, aa, ab, \ldots\} = a(a+b)^*$

$= a(a+b)^*$

⇓ Regular

Then L is _____

A. Decidable Language
B. Undecidable Language
C. Regular Language
D. Both A and C

Decidable

21. Let L = { HTM | HTM accepts epsilon (w)}. = Set of all HTMs accepts ε

Membership
⇓
Decidable

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

22. Let L = { TM | TM accepts ab}.

Membership for TM
↳ RE but not rec
(UD)

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable ⇒ (UD & SD) RE but not rec
C. Undecidable language but not even partially decidable } ⇒ Not RE L
D. None

23. Let L = { TM | TM halts on ab}.

Halting problem ⇓ RE but not rec (UD)

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

24. Let L = { TM | TM accepts a particular string w}.

Membership for TM
⇓
RE but not rec

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

25. Let L = { TM | TM accepts some string }.
Then L is _____

Non emptiness
↓
RE but not rec

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

26. Let L = { TM | TM accepts only string ab }. → Not REL

$L(TM) = \{ab\}$

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

27. Let L = { TM | TM accepts a finite language}.
Then L is _____

Finiteness

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

Not REL

28. Let L = { TM | TM accepts a*}. ⇒ Not REC
Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

29. Let L = { TM | TM accepts non-empty language}.

Then L is _____

TM accepts some strings

∴ RE but not rec

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

30. Let L = { TM | TM accepts REL}.
Then L is _____

Trivial

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

31. Let L = { TM | TM accepts recursive set}. ⇒ not REL
Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

32. Let L = { TM | TM accepts regular set}. ⇒ Not $\overline{REL}$

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

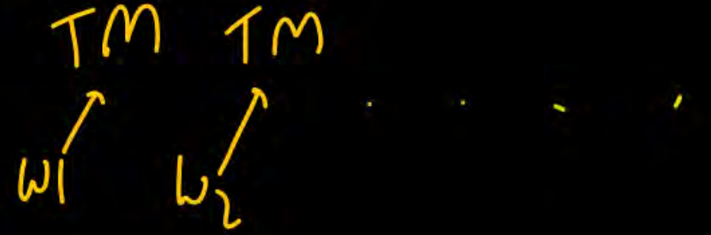
33. Let L = { TM | TM has at least 3 states}.
Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

$|L(TM)| \geq 3$

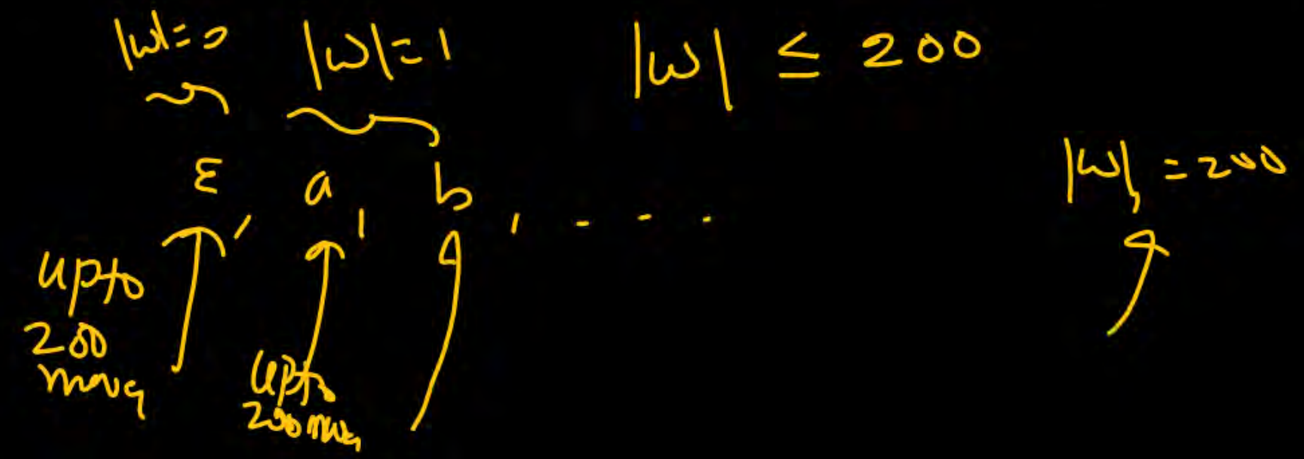
34. Let L = { TM | TM accepts at least 3 strings}. ⟹ RE but not rec
Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None



35. Let L = { TM | TM reaches state q within 200 moves}.
Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None



36. Let L = { TM | |L(TM)|>=2}. → REL but not RCL
Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

37. Let L = { TM | |L(TM)|<=2}. → Not RE

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

= Set of all TMs

38. Let L = { TM | L(TM) is countable}.

Trivial

Then L is _____

$\bar{L} = \{TM \mid L(TM) \text{ is not countable}\}$

$= \phi$

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

39. Let L = { TM | L(TM) is uncountable}. $= \phi$

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

40. Let L = { < M, w, k > | M is a TM that halts on w within k steps}.

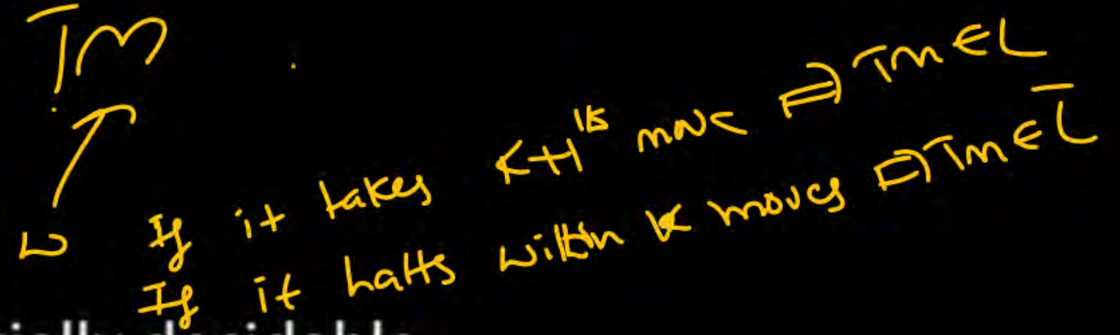
Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

41. Let L = { < M, w, k > | M is a TM that does not halt on w within k steps}.

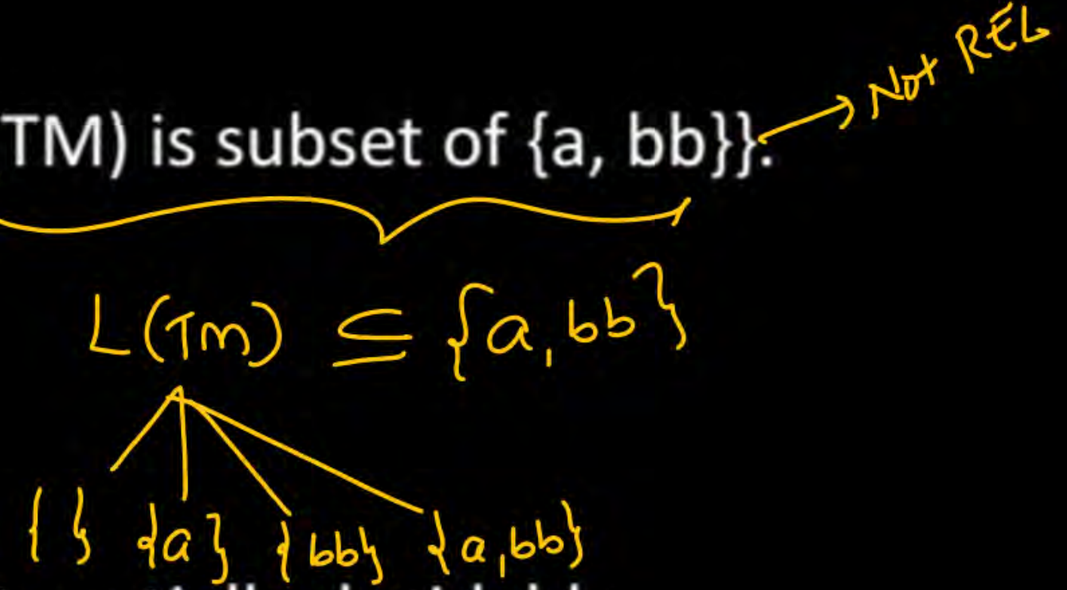
Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None



42. Let L = { M | M is a TM, L(TM) is subset of {a, bb}}.

Then L is _____



A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

43. Let L = { M | M is a TM, L(TM) is not subset of {a, bb}}.

$L(TM) \not\subseteq \{a, bb\}$

Then L is _____

Find some strings accepted by TM
Other than
a & bb

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

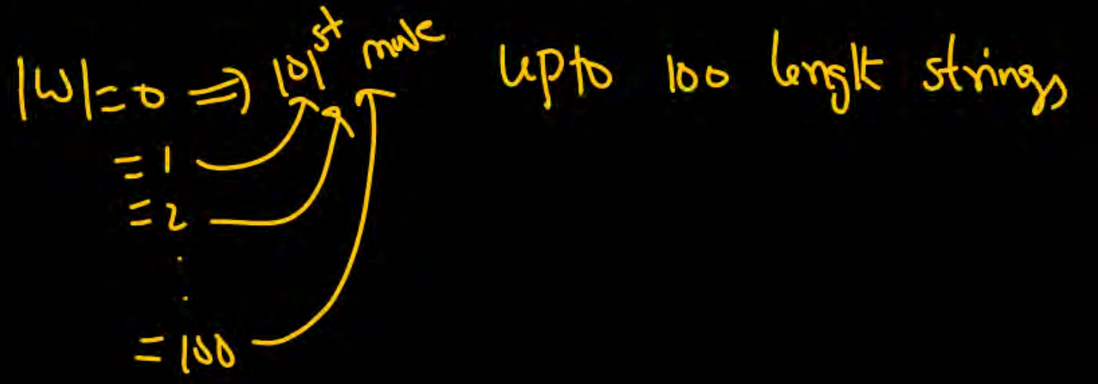
44. Let L = { TM | TM halts after 100 moves}.

Then L is _____

Whether TM halts after 100 moves.

(TM will not halt within 100 moves)

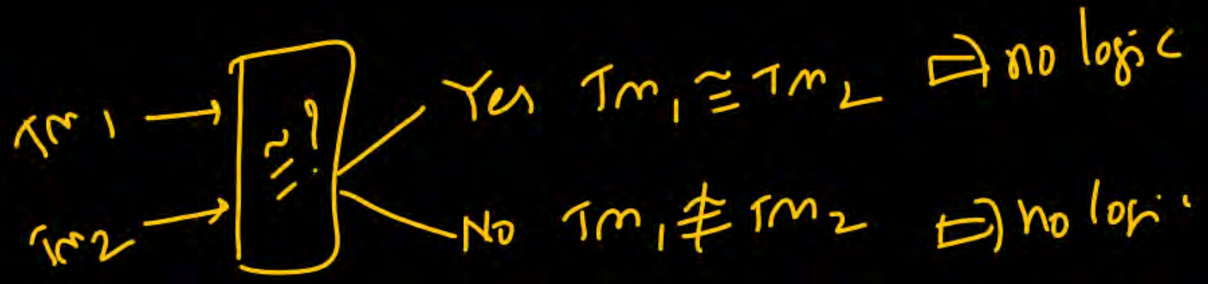
A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None



45. Let L = { TM | TM has 2 transitions}.

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None



46. Let L = { <M1, M2> | M1 is equivalent to M2}.

Equivalence for TMs

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

= set of all undecidable languages

47. Let L = { R | R is not decidable language}.

Undecidable language

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

48. Let L = { R | R is decidable language}.

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

49. Let L = { R | R is not REL}.

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

not RE L

50. Let L = { R | R is countable language}.

Then L is _____

A. Decidable Language
B. Undecidable Language but partially decidable
C. Undecidable language but not even partially decidable
D. None

UG (unrestricted Grammar)

LHS $\longrightarrow$ RHS

I) $(VUT)^* \longrightarrow (VUT)^*$

Standard

II) $\underbrace{(VUT)^* V (VUT)^*}_{LHS} \longrightarrow \underbrace{(VUT)^*}_{RHS}$

III) $(VUT)^+ \longrightarrow (VUT)^*$

CSG

But $|LHS| \leq |RHS|$

$S \rightarrow aAB$

$aA \rightarrow aa$

$aB \rightarrow b$

$L = \{ab\}$

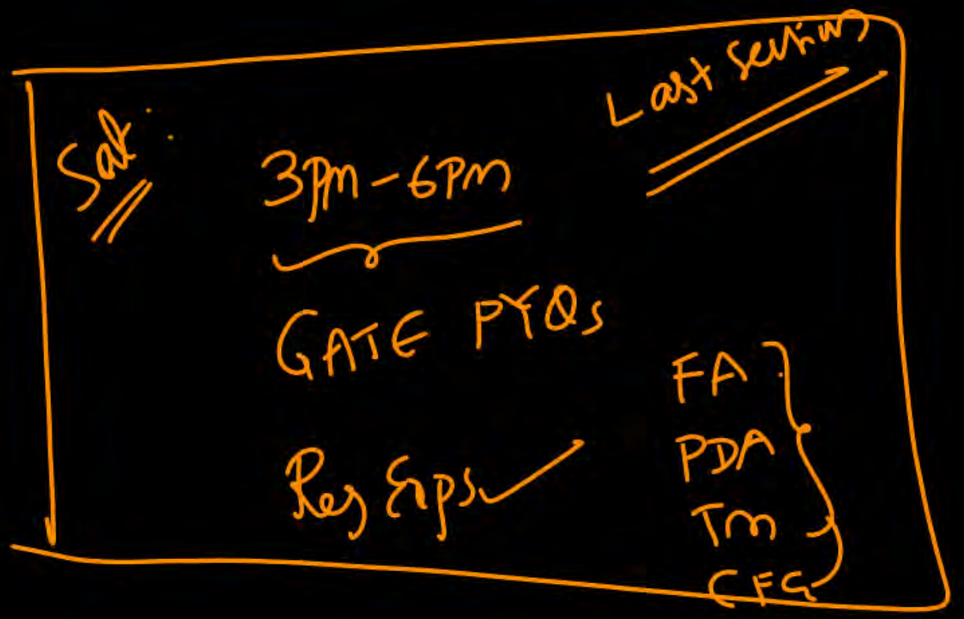
$S \Rightarrow aAB$

$\Rightarrow aaB$

$\Rightarrow ab$ //

Summary

↳ practice



Thank you