CS & IT ENGINEERING

Theory of Computation

Lecture No.- 09

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Recap of Previous Lecture

Topic	Regular Languages
Topic	Context Free Languages
Topic	Turing Machine
Topic	Undecidability Concepts

Topics to be Covered

- Topic: Regular Languages
- Topic: Context Free Languages
- Topic: Turing Machine
- Topic: Undecidability Concepts

[MCQ]

#Q111. Which of the following is TRUE?

1. If both L and complement of L are RE ,then L is recursive. T
2. If L is recursive then so is the complement of L. T

A Only 1

B Only 2

C Both 1 and 2

D None of these

[MSQ]

#Q112. Which of the following L is Recursively Enumerable Language?

A L is Regular

B L is Decidable

C L is Enumerable

D L is Undecidable

[MSQ]

#Q113. If L is recursive language, then complement of L is __Recursive

REL

A Recursive

B Undecidable

C RE

D CFL

[MCQ]

#Q114. Consider the following statements.

I. Every decidable set is countable T
II. Every RE set is countable T
III. Every countable set is RE False

How many of the above statements is/are true?

A 0

B 1

C 2

D 3

[MSQ]

#Q115. Complement of not REL is _____

Not REL ⟹ RE but not rec OR Not REL

= Never be rec
= UD
= Not rec

A Recursive

B Undecidable

C REL

D None of these

[MSQ]

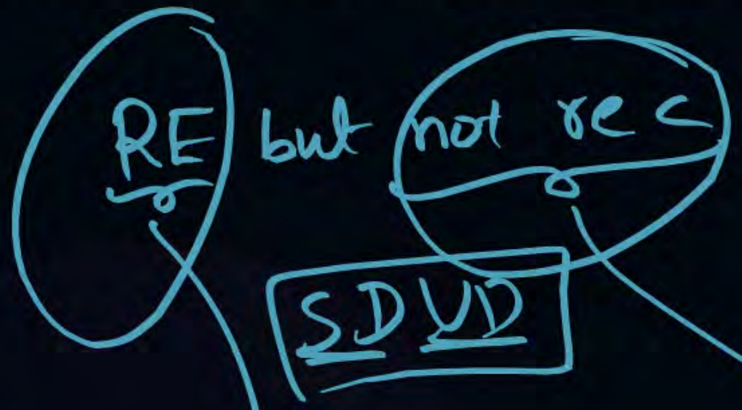
"State Entry problem"

#Q116. Given a TM 'M' and a state 'q' of M, does M ever enter state q on some input?

Particular

→ Yes: Reaches state q
↳ logic exist

→ No: Doesn't reach state q
↳ logic not exist

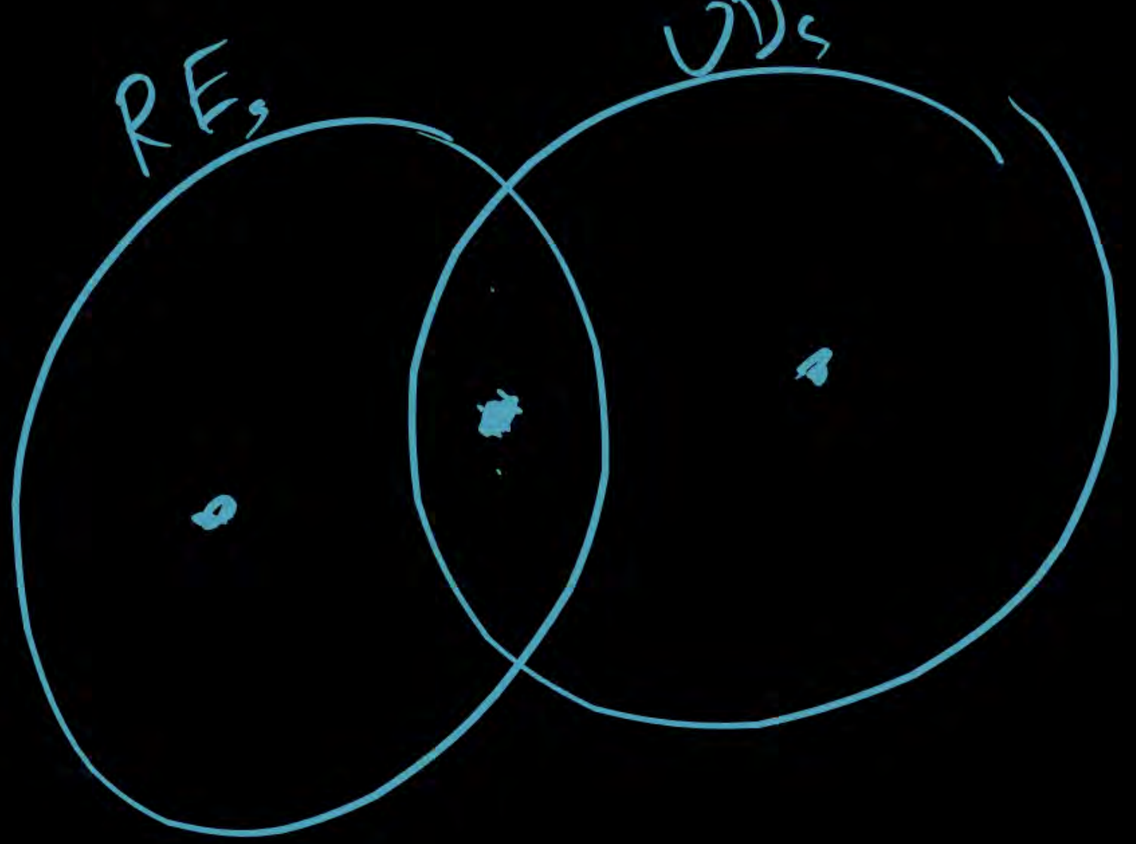


A Recursive

B Undecidable (UD)

C RE (SD)

D RE but not recursive


REs
UDs

[MSQ]

#Q117. Does 'M' ever enter state 'q' on input 'abb'?

TM

RE but not rec
(SDUD)

A Recursive

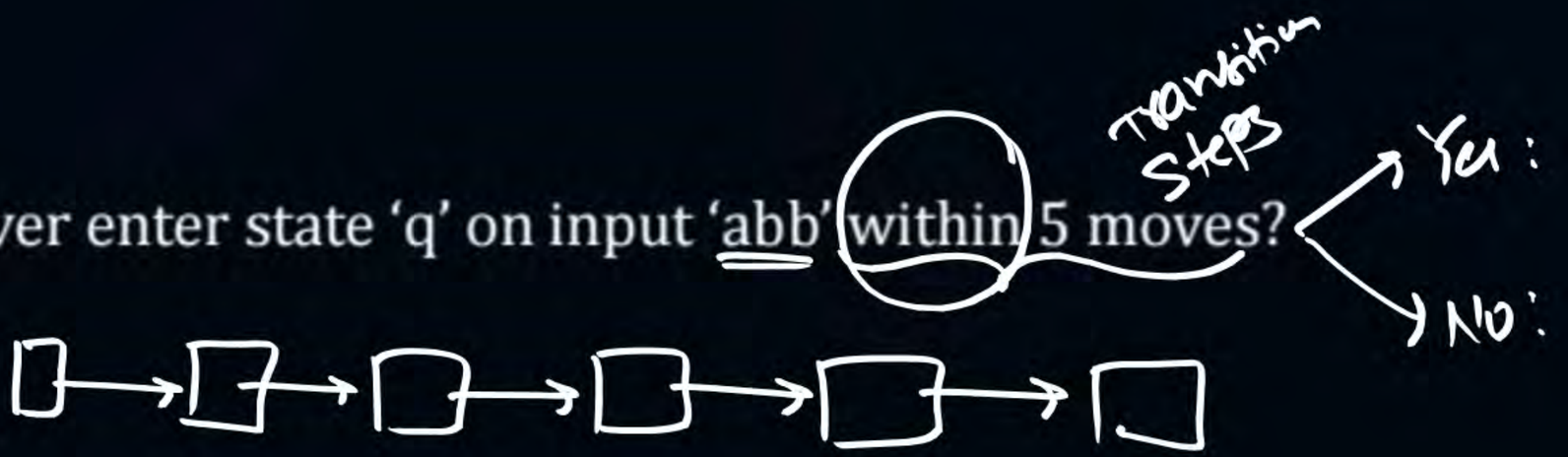
B Undecidable

C RE

D None of these

[MSQ]

#Q118. Does 'M' ever enter state 'q' on input 'abb' within 5 moves?



A Recursive

B Undecidable

C REL

D ~~None of the~~ RE but not Rec

[MSQ]

#Q119. "TM accepts epsilon" is __

Is $\varepsilon \in L(TM)$?

Is TM accepts ε ?
(membership)

Yes: ε accepted by TM logic ✓

No: ε not accepted by TM logic X

A Recursive

B Undecidable

C RE

D ~~None of these~~
RE but not recursive

[MSQ]

#Q120. "TM accepts only epsilon" is __

IS $L(TM) = \{\varepsilon\}$?

Yes: TM should accept ε and TM should not accept any other string

NO: TM may accept nothing OR TM should accept some string other than ε.

logic X

logic X

Not RE

A Recursive

B Undecidable ✓

C REL

D None of these

[MCQ]

#Q121. Which of the following problem is Decidable for TM?

A Membership

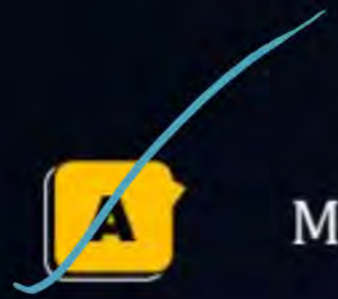
B Halting

C Equivalence

D None of these

[MCQ]

#Q122. Which of the following problem is RE but not recursive for TM?



A. Membership
- Yes ⇒ logic ✓
- No ⇒ logic ✗

B. Halting
- Yes ⇒ logic ✓
- No ⇒ logic ✗

C. Finiteness
- Yes ⇒ logic ✗
- NO ⇒ logic ✗

D. ~~None of these~~ Equivalence
- Yes ✗
- No ✗

Equivalence for TM

[MCQ]

#Q123. {M | L(M) is regular language}

Whether M accepts regular. → Not RE

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

$\overline{L} = \{M_1', M_2', \ldots\}$

A Recursive

B REL

C Regular

D None of these

IS TM accepts regular language ?

IS " " finite " ?

IS " " CFL ?

IS " " CSL ?

IS " " Recursive ?

⇒ Not RE

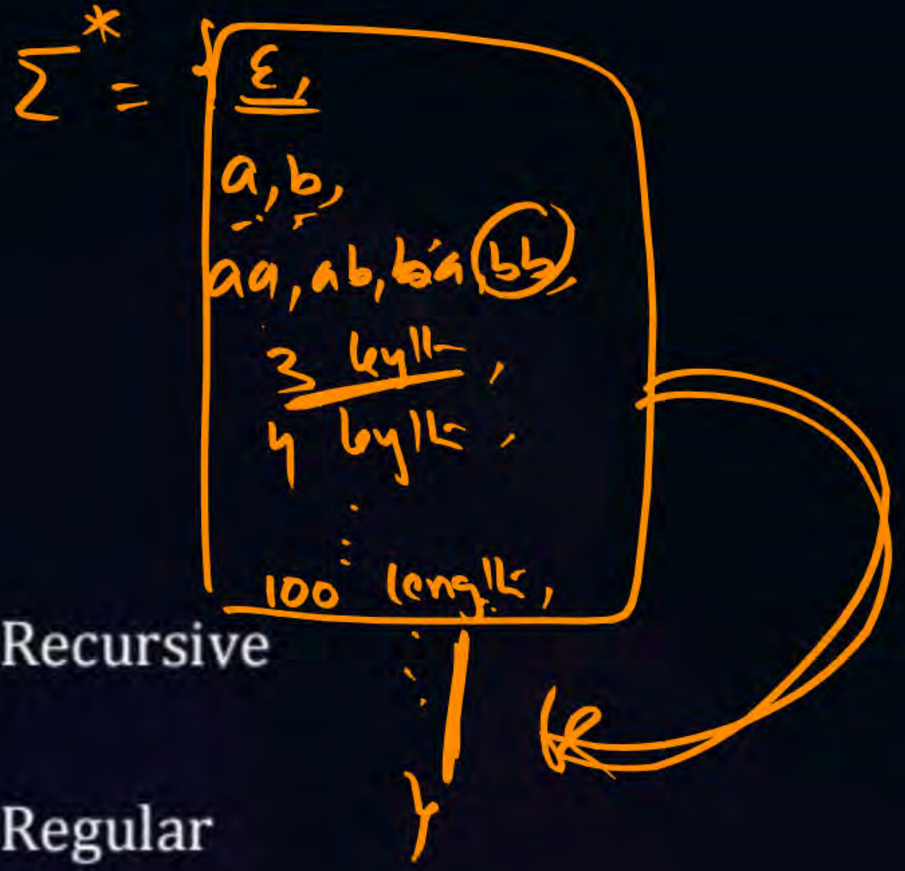
Trivial IS " " REL ? ⇒ Decidable

[MSQ]

#Q124. {M | M halts on all inputs within 100 steps}

Yes: upto 100 lengths, all halts within 100 moves

No: atleast one string within 100 length strings takes 101^{th} move.



A Recursive

B REL

C Regular

D None of these

REL but not recursive

[MSQ]

#Q125. {M | M halts on all inputs after 100 steps} ⇨ Check upto 100 length strings

M should not halt within 100 steps

Verify each string should take 101^{st} more

for every ip

I will write GATE exam after year 2025.

↳ I may write GATE after 2025
OR
I may not write

I will check upto 2 years

A Recursive

B REL

C Regular

D None of these

THANK - YOU