G.H. RAISONI COLLEGE OF ENGINEERING

2020-2021 EVEN TERM

CAE-1 EXAMINATION SUMMER-2021 (ONLINE MODE)

DEPARTMENT: ARTIFICIAL INTELLIGENCE

SEM/SEC : 4th / A DATE: 22/04/2021

SUBJECT : TOC

ROLL NO: A-58

NAME : SHIVAM TAWARI

REG. NO : 2019AAIE1117028

Q.1.

Q.) S → CA / BB,
B → b / SB,
C → b
A → a

⇒ Replace,
S with A1,
C with A2
A with A3

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B with A_4

∴ We get,

$A_1 \rightarrow A_2A_3 \mid A_4A_4$

$A_4 \rightarrow b \mid A_1A_4$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

Alter the rules so that the non-terminals are in ascending order, such that, if the production is of the form $A_i \rightarrow A_jx$, then,

$i < j$ and should never be $i \geq j$

$A_4 \rightarrow b \mid A_1A_4$

$A_4 \rightarrow b \mid A_2A_3A_4 \mid A_4A_4A_4$

$A_4 \rightarrow b \mid bA_3A_4 \mid A_4A_4A_4$

Left Recursion

$A_2 \rightarrow b$

$A_3 \rightarrow a$

∴ Remove left recursion

Introduce a new variable to remove the left recursion.

$A_4 \rightarrow b \mid bA_3A_4 \mid A_4A_4A_4$

$Z \rightarrow A_4A_4 \mid A_4A_4Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$A_1 \rightarrow bA_3 \mid bA_4 \mid bA_3A_4A_4 \mid bZA_4 \mid bA_3A_4ZA_4$

$A_4 \rightarrow b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

$Z \rightarrow bA_4 \mid bA_3A_4A_4 \mid bZA_4 \mid bA_3A_4ZA_4 \mid bA_4Z \mid bA_3A_4A_4Z \mid bZA_4Z \mid bA_3A_4ZA_4Z$

$A_2 \rightarrow b$

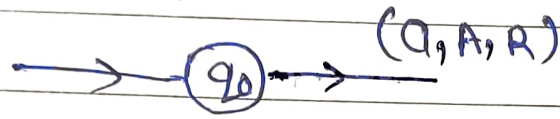
$A_3 \rightarrow a$

Q.2.

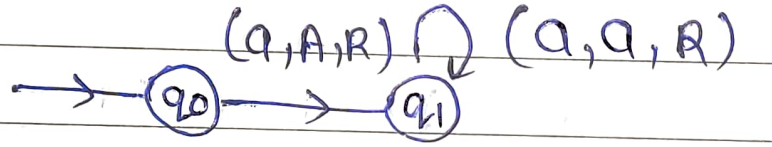
a.

Soln. L =

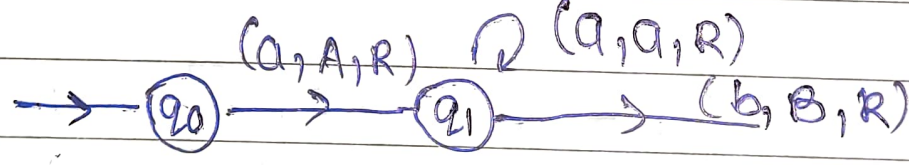
|a|a|b|b|c|c|Δ|Δ



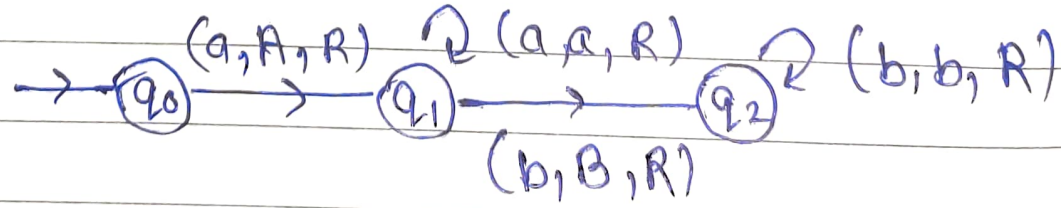
|A|a|b|b|c|c|Δ|Δ



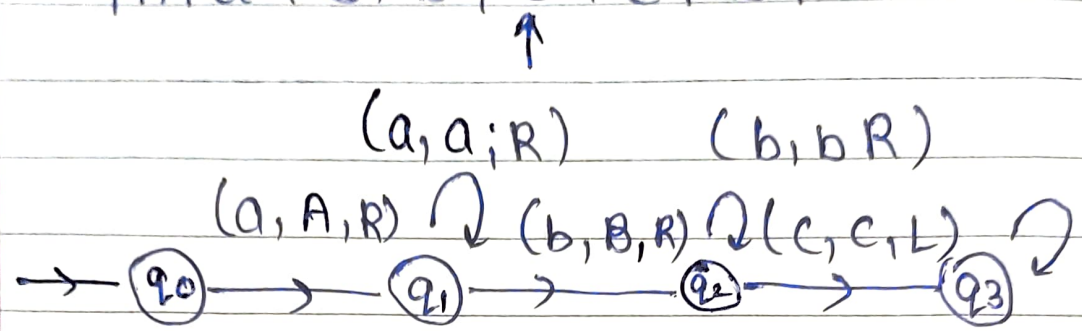
|A|a|b|b|c|c|Δ|Δ



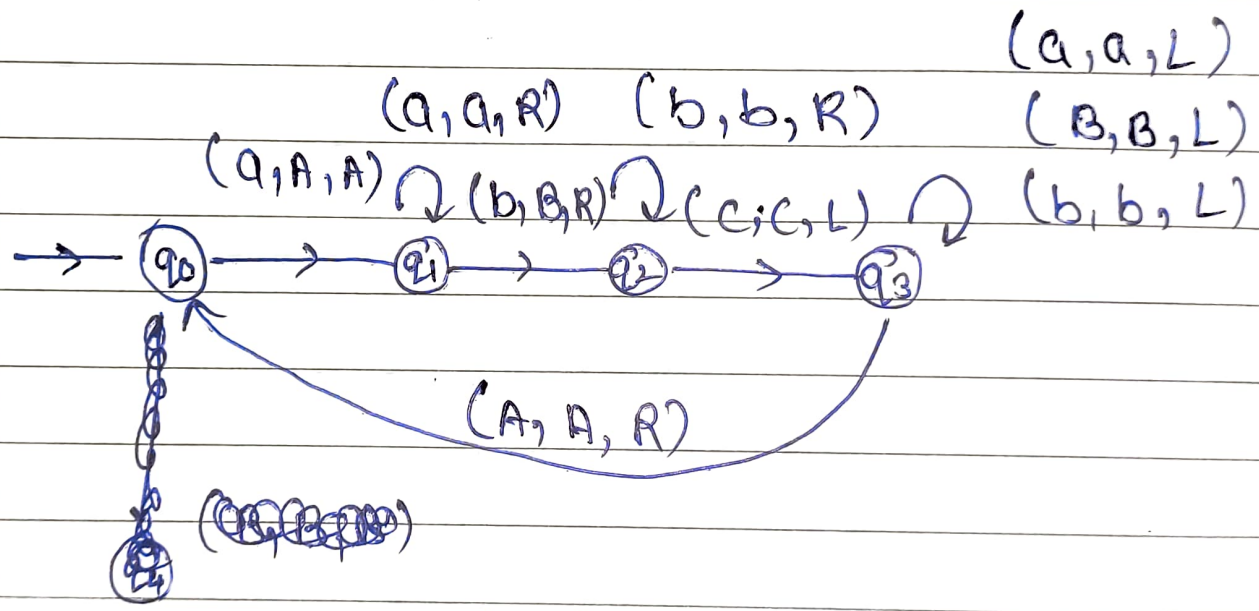
|A|a|B|b|c|c|Δ|Δ



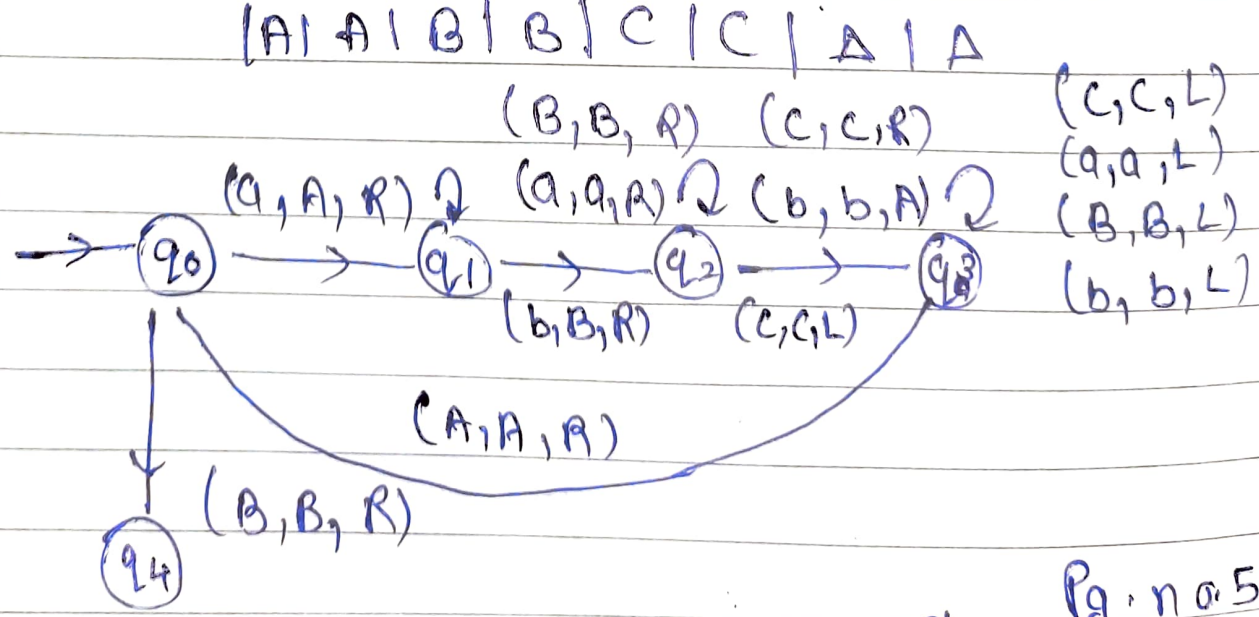
| A | a | B | b | c | c | Δ | Δ



| A | a | B | b | c | c | Δ | Δ



| A | A | B | B | C | C | Δ | Δ



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Q. 2.

b. Halting means that the program on certain input will accept it and halt or reject it and halt and it would never go into an infinite loop. Basically halting means terminating. So, we can have an algorithm that will tell that the given program will halt or not.

Example:

Turing Machine Halting Problem

At first we have a Turing machine as a halting machine that produces 'yes' or 'no' in a finite amount of time.

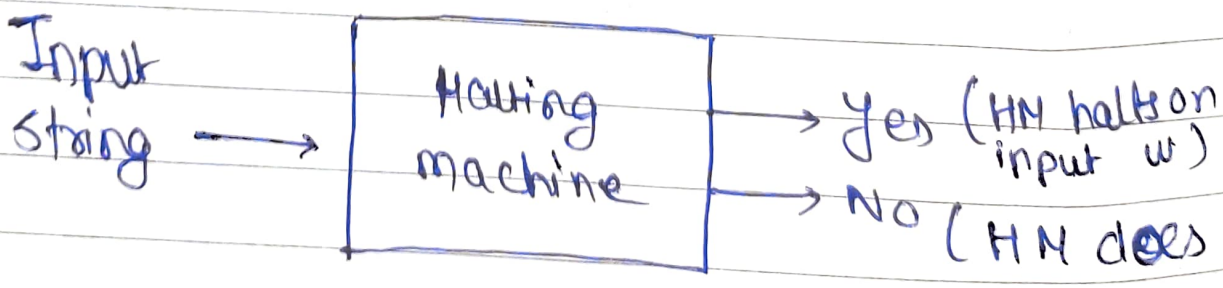

Fig. no. 6

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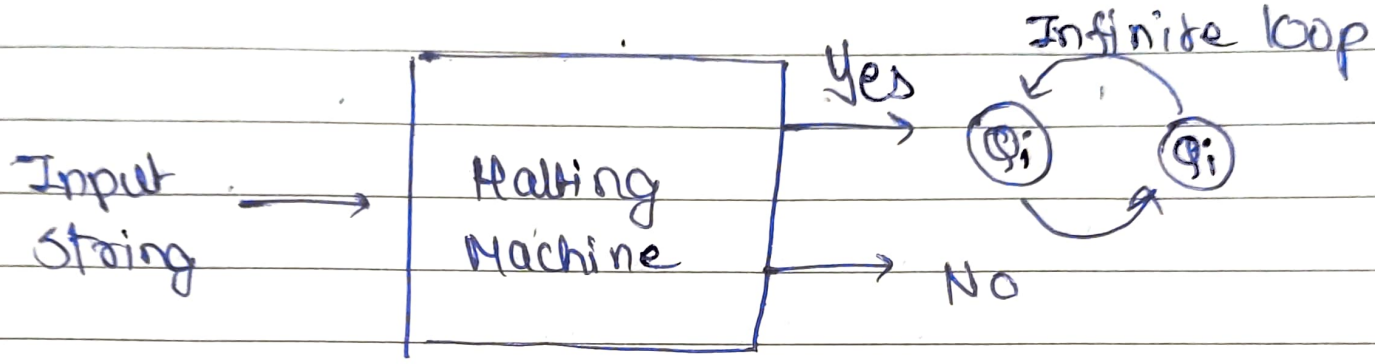
Now, inverted halting machine $(HM)'$:
→ If H returns Yes, then loop forever
→ If H returns NO, then halt.



Further, a machine $(HM)_2$ which input itself is constructed as follows :

- If $(HM)_2$ halts on input, loop forever.
- Else, halt

Here, we have got a contradiction.
Hence, the halting problem is undecidable.