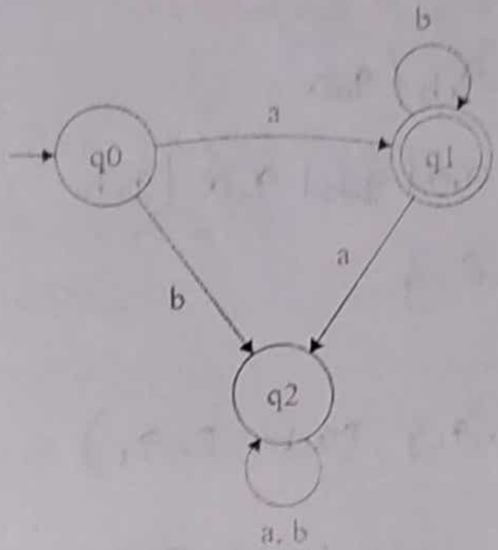
Tutorial #	07	Student ID	2300030642
Date	17/09/24	Student Name	S.Nishitha.

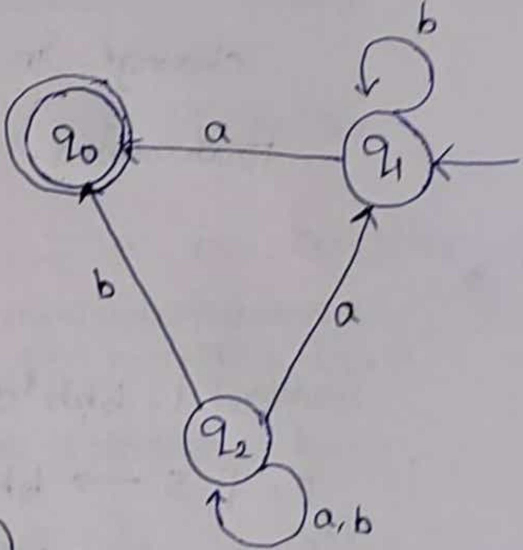
Pre-Tutorial (To be completed by student before attending tutorial session)

1. Consider the following automaton that accepts the language ab^*



Generate a Right Linear Grammar for the automaton.

Solution:



$P': \{ q_1 \rightarrow bq_1 \mid aq_0$

$q_2 \rightarrow aq_1 \mid bq_0 \mid aq_2 \mid bq_2$

$q_0 \rightarrow \epsilon \}$

$G = (\{q_0, q_1, q_2\}, \{a, b\}, P', q_1)$

Date: 07 17/09/24 Student ID: 2300030642 Student Name: S.Nishitha

2. Write the Left Linear Grammar for the above Finite Automaton. What did you ob Explain.

Solution:

$P = \{ q_1 \longrightarrow q_1 b / q_0 a$

$q_2 \longrightarrow q_1 a / q_0 b / q_2 a / q_2 b$

$q_0 \rightarrow \epsilon \}$

$G = (\{q_0, q_1, q_2\}, \{a, b\}, P, q_1)$

Here from right linear grammar, the change in left grammar is only in productions.

3. Write Left-Linear Grammar that generates the language L (bbb^*aaaa^*)

Solution: $L = bbb^* aaaa^*$

$P = \{ S \longrightarrow bbAaaaB$ $\quad \{ S \rightarrow \cancel{Abb}^{aaa} B\cancel{aaa} bbA$

$A \rightarrow bA / \epsilon$ $\Rightarrow$ $A \rightarrow bA / \epsilon$

$B \rightarrow aB / \epsilon \}$ $\quad B \rightarrow aB / \epsilon \}$

left linear grammar:

$P' = \{ S \rightarrow BaaaAbb$

$A \rightarrow Ab / \epsilon$

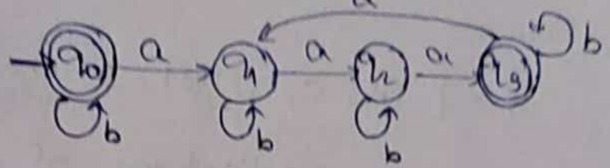
$B \rightarrow Ba / \epsilon \}$

Tutorial # 07 | Student ID 2300030642
Date 12/09/24 | Student Name P.Nikshitha

IN-TUTORIAL (To be carried out in presence of faculty in classroom)

1. Find a regular grammar for the language over $\{a, b\}$ where the number of $a's$ in any string is divisible by 3 .

Solution: $L = (aaa)^*$



$G = (\{q_0, q_1, q_2, q_3\}, \{a, b\}, P, q_0)$

$P = \{ q_0 \rightarrow bq_0 \mid aq_1 \mid \epsilon$

$q_1 \rightarrow bq_1 \mid aq_2$

$q_2 \rightarrow bq_2 \mid aq_3$

$q_3 \rightarrow bq_3 \mid aq_1 \mid \epsilon \}$

2. Let L_1 and L_2 be two languages with $L_1 \subseteq L_2$. In what condition L_2 must be a regular language?

Solution: for $L_1 = L_2$ both L_1 and L_2 are regular languages. For $L_1 \subset L_2$, there is no condition for L_2 to be a regular or non-regular Because here there is no condition on L_1. so, $L_1 \subseteq L_2$ is regular and L_2 is also regular language.

3. Let $L = \{w \in \{0,1\}^* : n_0(w) = n_1(w)\}$. Is L regular? If you find it to be not r prove it. Here $n_0(w)$ = count of zeros in w, and $n_1(w)$ = count of 1's in w

Solution:

$L = \{ 01, \epsilon, 0101, 1100, 001011, \ldots \}$

By using applications of pumping lemma,

Step1:

let, constant $n = 4$

Step2: $z = uvw$ $\quad |z| \geq n$

where, $|uv| \leq n$

$|v| \geq 1$

$z = \underset{u}{1}\underset{v}{1}\underset{w}{00}$. $\quad 4 \geq 4$

$|uv| \leq n \Rightarrow 2 \leq 4$ ✓.

$|v| \geq 1 \Rightarrow 1 \geq 1$ ✓

$uv^iw \in L$

$i = 0, 1, 2, 3, \ldots$

$i = 0 \rightarrow 1(1)^0 00 = 100 \notin L$

L is not regular.

Tutorial #	07	Student ID	2100030642
Date	12/9/24	Student Name	S.Nandhitha

4. Is the language $L = \{a^n b^n : n \geq 0\}$ a regular language? If you find it to be not a regular language prove it. Write each step.

Solution:

$L = \{ \epsilon, ab, aabb, aaabbb, \ldots \}$

1. let $n = 4$

2. $z = uvw$

$z = \underset{u\,v\,w}{\underline{a}\,\underline{a}\,\underline{bb}}$

$|z| \geq n \Rightarrow 4 \geq 4$

$|uv| \leq n \Rightarrow 2 \leq 4$

$|v| \geq 1 \Rightarrow 1 \geq 1$

3. uv^iw

$i = 0, 1, 2, 3, \ldots$

$i = 0 \Rightarrow a(a)^0bb = abb \notin L$

$\therefore$ L is not regular.

5. Consider the grammar: $S \to aS \mid bA, \ \ A \to bA \mid \varepsilon$. Is it a regular gram[...] it to be a regular grammar determine whether it is right linear or left lin[...] language generated by the given grammar.

Solution:

$P = \{ S \to aS \mid bA$

$\quad A \to bA \mid \epsilon \}$

$G = (\{S, A\}, \{a, b\}, P, S)$

It is ~~regramm~~ regular grammar.

Because it consists,

it is in the form $T^*V \mid T^*$.

Given production is in the form of T^*V.

so, it is Right regular grammar.

Post-Tutorial (To be carried out by student after attending tutorial session)

Consider the grammar: $S \rightarrow aS \mid bS \mid \varepsilon$. Is it a regular grammar? If you find it to be regular, determine its type. Write the language generated by the grammar.

Solution:

It is in the form of $T^*V \mid T^*$. So, it is regular grammar.

$S \rightarrow aS \mid bS \mid \epsilon$

$\therefore$ $L = (a^*b^*)^*$

Let $L_1 = \{a^n : n > 0\}$ and $L_2 = \{b^n : n > 0\}$ be two regular languages. Consider another language L_3 where $L_3 = L_1 \cup L_2$. Is L_3 a regular language? Explain.

Solution:

If L_1 ~~[illegible]~~ is a regular language.

L_2 is a regular language.

If L_1 and L_2 are regular languages, then $L_3 = L_1 \cup L_2$ is regular language.

$L_3 = \{a^n, b^n ; n > 0\}$

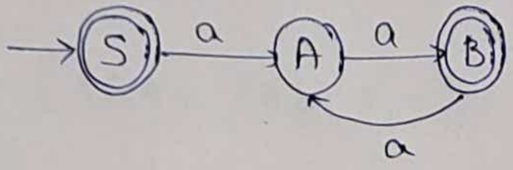
$\therefore$ L_3 is regular language.

Tutorial #	07	Student ID	2100030642
Date	17/9/24	Student Name	S.Neeharika

3. Consider the language $L = \{a^n : n \text{ is even}\}$. Is L a regular language? Pr

Solution:

$L = \{\epsilon, aa, aaaa, \cdots\} = (aa)^*$



$P = \{ S \to aA \mid \epsilon$

$A \to aB$

$B \to aA \mid \epsilon \}$

$G = (\{S, A, B\}, \{a\}, P, S)$

$\because$ It is regular language $(T^* V \mid T^*)$

(For Evaluator's use only)

Comment of the Evaluator (if Any)	Evaluator's Observation
	Marks Secured: ________ out of 50 Full Name of the Evaluator: Signature of the Evaluator Date of Evaluation: