1. State that pumping lemma for regular sets and show that the regular set L = $\{0^{n^2} \mid n \geq 1\}$ (or) L= $\{0^k / k=i^2, i \geq 1\}$ is not regular.

L is regular

p= pumping language.

$s = 0^{p^2}$

$s = xyz$

y = is a string of 0's

The language is regular because no matter what the language is going to contain a string of 0's.

2. State that pumping lemma for regular sets and show that the regular set L = {W/W^R /W is a set of input string {0,1} or {a,b}

L is regular

p = pumping length

$s = 1^p 0^p 0^p 1^p$

$s = xyz$

y = string of 1's at the end

$x(y^i)z \in L$ for all i

ex. i = 2

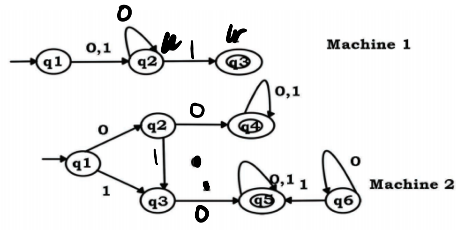
$x(y^2)z = 10011$

The string is not in the language.

Doesn't meet Pumping Lemma

The language is not regular via contradiction.

3. Verify the two finite automaton M1 ,M2 given are equivalent over the input symbol{0,1}



Here is the table,

States	0	1
q1	q2	q2
q2	q2	q3
q3	null	null

states	0	1
q1	q2	q3
q2	q4	q3
q3	q5	null
q4	q4	q4
q5	q5	q5
q6	q6	q5

States	0	1
(q_1, q_1)	(q_2, q_2)	(q_2, q_3)
(q_2, q_2)	(q_2, q_4)	

Intermediate/ Final

The 2 machines are not equal.

4. $L=\{0^n / n \geq 1\}$. Find CFG.

Any number of 0's ≥ 1. Ex: 0, 00, 000, ...

$S \rightarrow 0A$

$A \rightarrow 0 | 0A | \varepsilon$

5. Find L(G) where S →SS/bS/Sb/a

$L(G) = a^* \Sigma^* + b\Sigma^+$

6. Consider the grammar G=({A,S},{a,b},p,s) where p consist of S → aAS/a A → SbA/SS/ba
   Draw the derivation tree for string"aabbaa"

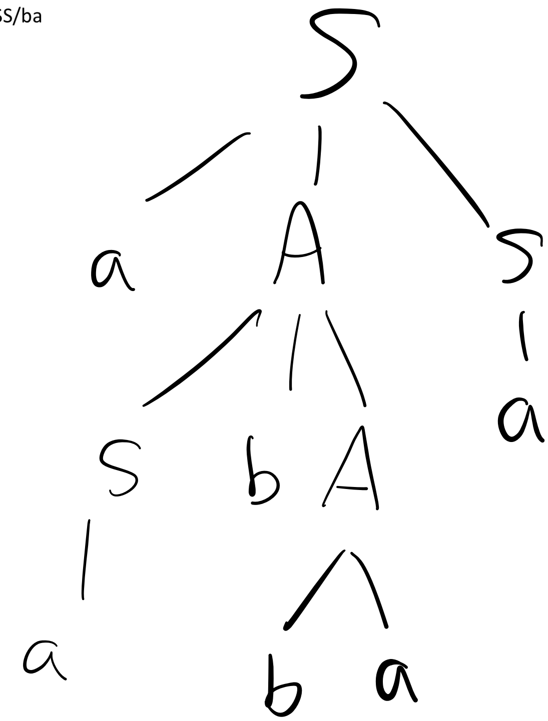
$S \to aAS$

$S \to aSbAS$

$S \to aabAS$

$S \to aabbaS$

$S \to aabbaa$



7. Derive the string "aabbabba" for LMD,RMD and parse tree using CFG given by G where production is S →aB/ba, A → a/aS/bAA B → b/bS/aBB

LMD

$S \rightarrow aB$

$S \rightarrow aaBB$

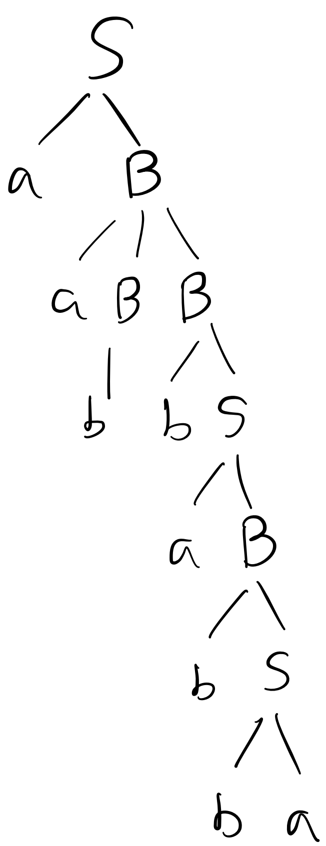
$S \rightarrow aabB$

$S \rightarrow aabbS$

$S \rightarrow aabbaB$

$S \rightarrow aabbabS$

$S \rightarrow aabbabba$



RMD

$S \rightarrow aB$

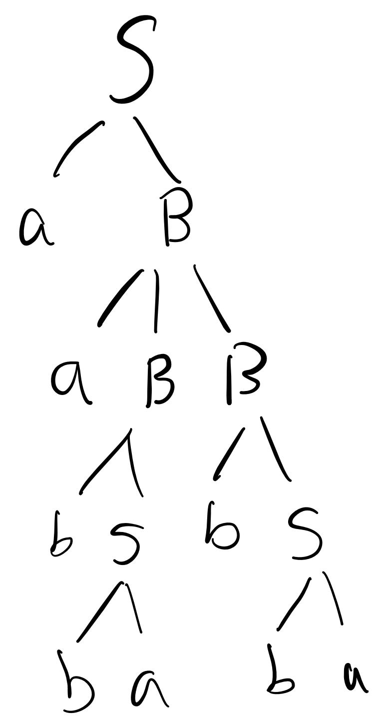
$S \rightarrow aaBB$

$S \rightarrow aaBbS$

$S \rightarrow aaBbba$

$S \rightarrow aabSbba$

$S \rightarrow aabbabba$



8. Prove that given CFG is ambiguous S →0B/1A A → 0/0S/1AA B → 1/1S/0BB

$S \to 0B \mid 1A$

$A \to 0 \mid 0S \mid 1AA$

$B \to 1 \mid 1S \mid 0BB$

0011

$S \to 0B$

$B \to 0BB$

$B \to 1$

$B \to 1$

✓

$S \to 0B$

$S \to 0B$

$B \to 0BB$

$B \to 1S$

$S \to$

X

101001

$S \to 1A$

$A \to 0S$

$S \to 1A$

$A \to 0S$

$S \to 0B$

$B \to 1$

✓

$S \to 1A$

$A \to 0S$

$S \to 1A$

$A \to 0$

X

The CFG is not ambiguous

9. Consider the CFG G given below. Find a CFG G' with no e-productions and no unit productions. S → ABA A → aA|e B → bB|e

$S \to ABA$

$A \to aA \mid e$

$B \to bB \mid e$

removing e-productions

$S \to ABA \mid BA \mid AB \mid B$

$A \to aA \mid a$

$B \to bB \mid e$

$S \to ABA \mid BA \mid AB \mid B \mid AA \mid A$

$A \to aA \mid a$

$B \to bB \mid b$

removing unit productions

$S \to ABA \mid BA \mid AB \mid bB \mid b \mid AA \mid aA \mid a$

$A \to aA \mid a$

$B \to bB \mid b$

10. Find a reduced grammar equivalent to the grammar: $S \rightarrow aAa$, $A \rightarrow bBB$, $B \rightarrow ab$, $C \rightarrow aB$

$S \rightarrow aAa$, $A \rightarrow bBB$, $B \rightarrow ab$, $C \rightarrow aB$

C is unreachable so it can be removed

$S \rightarrow aAa$, $A \rightarrow bBB$, $B \rightarrow ab$