Fall-2018

1) given A be the language of all palindromes over {0, 1}.
Containing equal no. of 0's and 1's.
→ Is A is content free or not?
If Yes give corresponding content free grammer of A.
→ If not show its not content free.

→ what is content free grammer:-

A content free grammer over an alphabet Σ (sometimes called terminal symbols) is a variables (or non-terminals) V, which includes the start symbol S, and set of rules of the form:

variable → some string of terminals and non-terminals

We use Pumping Lemma to prove that a language is not content free.

1) If A is a content free language then A has a pumping length 'p' such that any string 'S' where $S \geq P$ may be divided into 5 pieces $S = UVXYZ$ such that the following conditions must be true.

1) $uv^ixy^iz$ is in A for every $i \geq 0$
2) $|VY| > 0$
3) $|VXY| \leq P$

→ To prove that a language is not context free using pumping lemma for CFL we prove using contradiction.

i, Assume that A is context free.

ii, It has to have a pumping length say p.

iii, All string larger than p can be pumped $|s| \geq p$.

iv, Find a string s in A such that $|S| \geq p$.

v, Divide s into uvxyz.

vi, Show that $uv^ixy^iz \notin A$ for some i.

vii, Then consider the ways that s can be divided into uvxyz.

viii, Show that none of these can satisfy all the 3 pumping conditions at the same time.

ix, S cant be pumping contradition.

L = { palindrome over {0,1} containing equal no of 0's & 1's}

1) Assume that L is content free.

2) pumping length According to condition.

let pumping length be (p) = 4.

i.e 4 0's & 4 1's.

L = {11000011}.

3) Divide language into 5 parts uvxyz.

$L = \{\underbrace{11}_{u}\,\underbrace{00}_{v}\,\underbrace{00}_{x}\,\underbrace{1}_{y}\,\underbrace{1}_{z}\}$

| | |
|---|---|
| U = 11 | $\lvert u\rvert = 2$ |
| V = 00 | $\lvert v\rvert = 2$ |
| X = 00 | $\lvert x\rvert = 2$ |
| Y = 1 | $\lvert y\rvert = 1$ |
| Z = 1 | $\lvert z\rvert = 1$. |

overall string length = 8

Case (1):- $L = uv^ixy^iz$ for $i \geq 0$.

let i = 2.

$L = 11(00)^2(00)(11)^2$

L = 1100000011111 (X) failed.

Scanned with CamScanner

Case (ii): $|vy| \geq 0$.

means $|3| > 0$ : true.

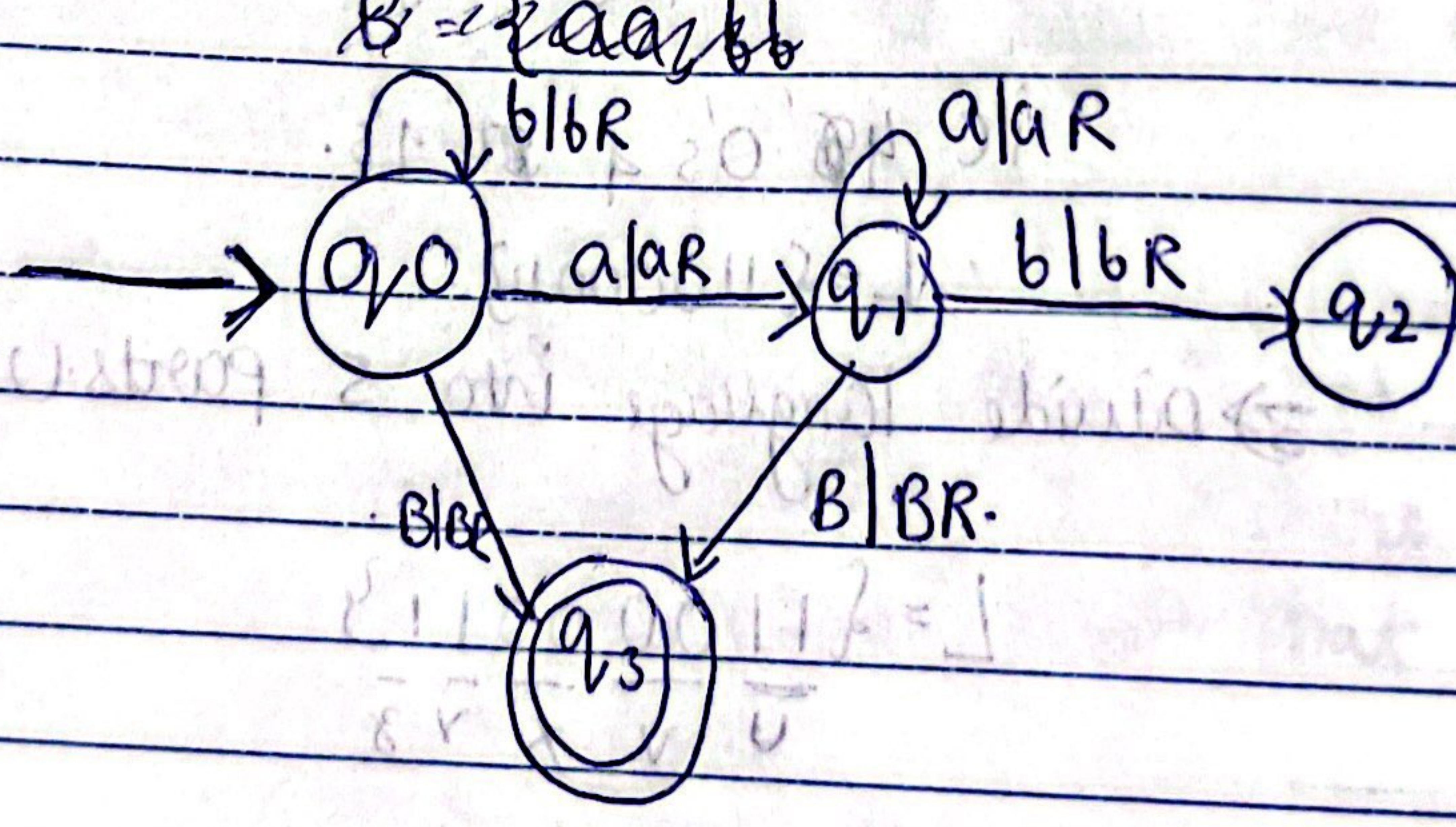
Case(iii):- $|vxy| \leq p$

$5 \leq p$ Fail.

Therefore since the conditions are failing so language A is not in $uv^ixy^iz \notin L$.

So L = { palindromes over {0,1} containing equal no. of 0's & 1's } is not Content free.

2) Turing machine for that decides the following language B = {w : w does not contain the substring "ab" over $\Sigma$ = {a, b}}.




initial state $q_0$

Accept state - $q_3$

Reject state - $q_2$.

→ In start, if b comes any no. of times we will just keep b as it is and it will move right

→ After b, if 'a' will come then will keep 'a' as it is and will move to right of it

→ if after 'a', 'b' will come we will reject

→ from $q_0$, $q_1$ we get ant blank then we simply move to q3 state. accept//.

3) P-class:-

a) → P means polynomial time. It is a collection of decidision problems (problems with yes or no answer) that can be solved by deterministic machine in polynomial time.

b) Is this true or false. if $A \leq PB$ and $B \in P$, then $A \in P$. please prove your answer.

→ $A \leq PB$.

suppose . $A = PB$, B belongs to P class.

or $A < PB$, B belongs to P.

Acc. to P class rule, the problem that intersect with P-class will also belong to P-class.

$\Rightarrow A \in P$ class//.