The Choice School
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Automata Theory
Quiz 1

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1. ~~Sol~~ Consider a language L with i strings namely $L = \{ a_1, a_2, a_3, a_4, \dots a_i \}$

We can write a regular exhression of the form:

$$R = a_1 + a_2 + a_3 + a_4 + \cdots + a_i$$

This regular expression accepts this language L and can be converted to a FSA.

$\therefore$ any languag with only a finite number of strings ~~can be converted to~~ is a regular language.

2. First consider a non-regular language N and let A be a regular language. If $N \subseteq A$ then A is no longer regular or N is, in fact, regular.
$\Rightarrow$ Non-regular languages cannot be a subset of regular languages. $\rightarrow$ ①

In the given case of $B \overset{\cdot}{\leftarrow} C$ this language is always a subset of B since it can only contain ~~longer~~ strings that are in B.
So by ①, ~~the~~ it follows that $B \overset{\cdot}{\leftarrow} C$ is also regular.

3. ~~A → a~~ can be remove and any where A is present a can be replaced.

Let $B' \rightarrow b$

Now $A \rightarrow B$ becomes
$A \rightarrow BB'$
and $B \rightarrow Bb$ becomes
$B \rightarrow BB'$

Now P =
{ $S \rightarrow AB$
$A \rightarrow BB'$
$A \rightarrow a$
$B' \rightarrow b$
$B \rightarrow BB'$ }
starting symbol is S. and total number of rules is 5.

~~4.~~
5. Assuming w^R is the reverse of w.

$\Rightarrow |W^R| = |W|$

Consider a pumping length p.
and a string in L xcx^R such that $|x| = |x^R| = p$.
Assuming language L is regular, then a ~~simple~~ subset string of xcx^R in the first p symbols can be pumped infinitely and produce strings in L.

Notice that $|xc| \leq p$

On chosing any possible subset string from xc and pumping it, we get a string such that

$|w| \neq |w^R|$

this means the ~~pss~~ new string will not be in L and hence L is not regular.

6. Yes L is content free

i) G such that L(G) is

$(\{S, \}$ // variables

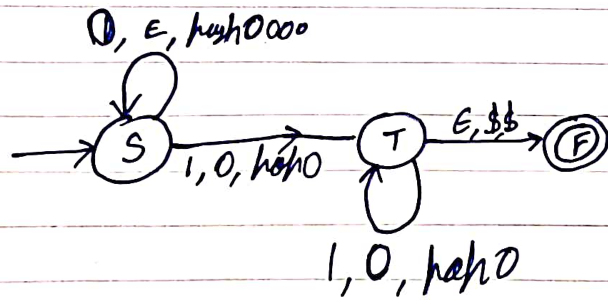
$\{0, 1, \epsilon\}$ // terminals

$\{S \rightarrow 0S111 \mid \epsilon\}$ // productions

$\{S\}$ // starting

$)$

ii)



// Assuming ~~that~~ first symbol pushed to stack is $

4. Consider string $x = aacbac$

it can be derived with

$S \rightarrow aS$, aS

$S \rightarrow aSbS$, $aaSbS$

$S \rightarrow c$, $aacbc$

and

$S \rightarrow aSbS$, $aSbS$

$S \rightarrow aS$, $aaSbS$

$S \rightarrow c$, $aacbc$

hence it is ambiguous.