Assignment - 02

(Question - 2 & 5)

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Course Code: CSE331

Section: 20

Group: Solo

Date of submission: 05.05.2025

Answer to the Q. NO - 02 (a)

Given,

$$L = \{ w \in \{0,1\}^* : w = 0^{n!}, n \geq 0 \}$$

Let's assume,

L is a regular language.

and p be the pumping length.

Now,

let,

$$\omega = 0^{p!} \in L$$

from the concept of pumping lemma,

We know,

$\omega = xyz$ [we can decide]

Now,

If we repeat y as many as times, then it should stay in the language.

by doing $xyyz$, then the number of 0s gets increased and it becomes greater than $p!$.

$\therefore xyyz \notin L$

Therefore, we have a contradiction.

$\therefore$ W is a non regular language.

(proved)

Ans. to the Q. NO - 02(b)

Given,

$$L = \{ w \in \{0,1\}^* : w = 0^a 1^b 1^c 0^d,$$

where $a+b = c+d$,

and $a,b,c,d \geq 0 \}$

let us assume,

L is a regular language.

and p be the pumping length.

let,

$$w = 0^p 1^p 1^p 0^p \in L$$

Now,

from the concept of pumping lemma,

We know,

$w = xyz$ [we can devide]

Now,

if we repeat y as many as times,

then it should stay in the language.

And if we repeat y ; p times ; which is $xy^p z$;

then the number of 0^a increases such

way that it makes :-

$$a+b \neq c+d$$

[P.T.O.]

$\therefore$ It does not satisfy the condition of the given language; [where it becomes, $a+b \neq c+d$]

$\therefore$ $xy^pz \notin L$

Therefore, we have a contradiction.

$\therefore$ L is a non-regular language.

(proved)

Ans. to the Q. NO - 02(c)

Given,

$$L = \{\omega \in \Sigma^* : \omega = a^i b^j, \text{ where } i > j, j \geq 0\}$$

Let us assume,

L is a regular language.

and p be the pumping length.

Let,

$$\omega = a^{(p+1)} b^p$$

[This string is in L because $(p+1) > p$, & $p \geq 0$]

[P.T.O.]

We know,

according to the concept of pumping lemma, w can be split as xyz,

here,

$x, y \rightarrow$ consists of only a's

$|y| > 0$

Where,

$|xy| \leq p$

$|y| > 0$

if we take:

$$x = a^r$$
$$y = a^s$$
$$z = a^{(p+1-r-s)} b^p$$

$\therefore w = xyz = a^r a^s a^{(p+1-r-s)} b^p$

$\therefore$ no. of a's $= p+1-s$

no. of b's $= p$

if we remove y:

the new string will be:

$xy^0z = xz$

$= a^{(p+1-s)} b^p$

But,

if $s \geq 1$,

then $p+1-s \leq p$

$\therefore$ no. of a's $\leq$ no. of b's

$\Rightarrow i \leq j$

$\therefore xz \notin L$

Therefore,

We have a contradiction.

$\therefore$ L is a non-regular language.

(proved)

Ans. to the Q. NO - 05(i)(a)

Given grammar,

$A \rightarrow A1 \mid 0A1 \mid 01$

$A \rightarrow 0A1$

$\rightarrow 0\ 0A1\ 1$

$\rightarrow 0\ 0\ 01\ 11$

$\rightarrow 0\ (0A1)\ 1$

$\rightarrow 0(0(01))\ 1$

Given string,

001111

using leftmost derivation:

A

$\rightarrow 0A1$

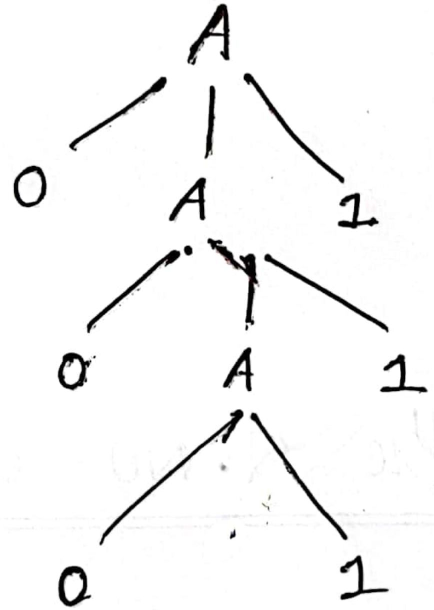
$\rightarrow 0(0A1)\ 1$

$\rightarrow 0\ (0(01))\ 1$

$\rightarrow 001111$

Ans. to the Q. NO - 05(i)(b)

parse tree for derivation in (a):



Ans. to the Q. NO- 05 (i) (c)

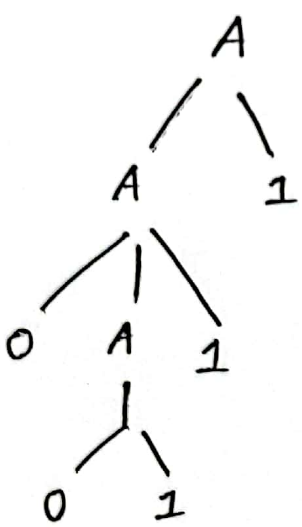
parse tree 2

$A \rightarrow A1$

$\rightarrow 0\ A1\ 1$

$\rightarrow 0\ 01\ 1$

$\rightarrow 001111$



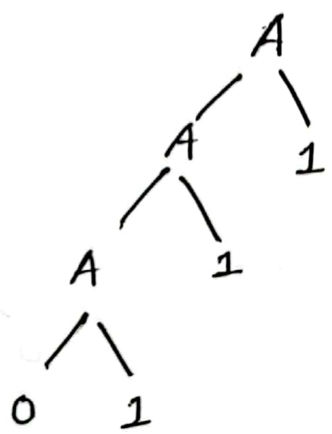
parse tree 3

$A \rightarrow A1$

$\rightarrow A1\ 1$

$\rightarrow 01\ 1\ 1$

$\rightarrow 001111$

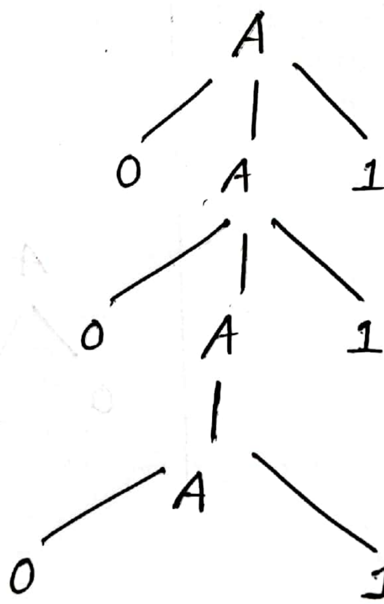


Ans. to the Q. NO - 05 (i) (d)

The string with exactly one parse tree of grammar is :

000111

parse tree :



Ans. to the Q. NO-05 (ii)(a)

Given,

$A \rightarrow 1A \mid 1C \mid 0B \mid 00A$

$B \rightarrow 0A \mid 1B \mid 00B$

$C \rightarrow 0C0 \mid 0C1 \mid 1C0 \mid 1C1 \mid \varepsilon$

And,

01011001

$\rightarrow$ 0B

$\rightarrow$ 01B

$\rightarrow$ 010A

$\rightarrow$ 0101A

$\rightarrow$ 01011A

$\rightarrow$ 0101100A

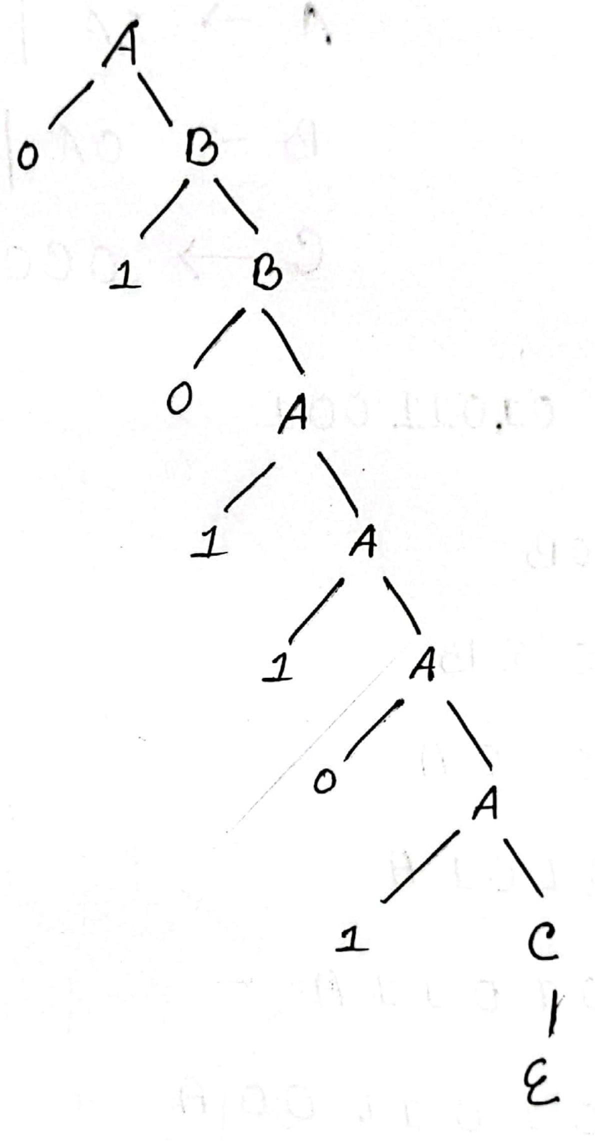
$\rightarrow$ 01011001C

$\rightarrow$ 01011001

(Ans:)

Ans. to the Q. NO- 05 (ii) (b)

parse tree (a):



Ans. to the Q. NO - 05 (ii)(c)

parse tree 2	parse tree 3

parse tree 2

01011001

→ 0B

→ 01B

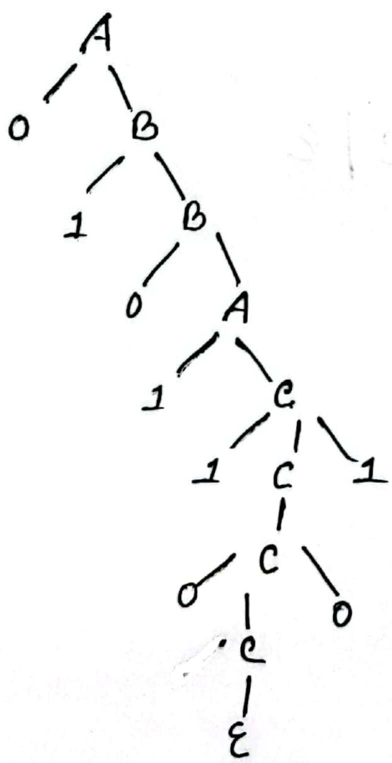
→ 010A

→ 0101C

→ 01011C1

→ 010110C01

→ 01011001



parse tree 3

01011001

→ 0B

→ 01B

→ 010A

→ 0101A

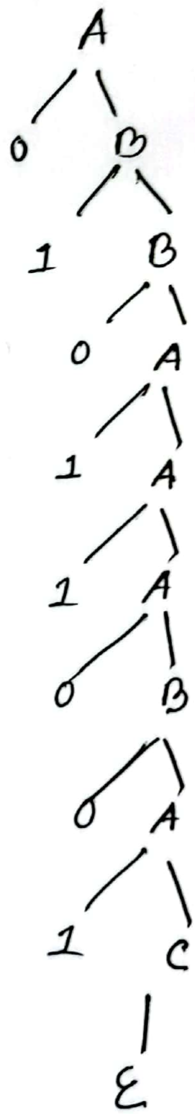
→ 01011A

→ 010110B

→ 0101100A

→ 01011001C

→ 01011001



∴ there are 2 more parse trees.

∴ The given grammar is ambigous.

Ans. to the Q. NO-05 (ii)(d)

The string w of length 6 :

0 1 1 1 0 1

Ans. to the Q. NO-05 (ii) (e)

unambiguous context free Grammar for the language represented by the given ambiguous grammar,

$$S \rightarrow 0B \mid 1C$$

$$B \rightarrow 0S \mid 1B$$

$$C \rightarrow 0C \mid 1C \mid \varepsilon$$