TOC Mid-2 Solutions.

Ans 1: $S \rightarrow 00S1 \mid \epsilon$

Ans 2: $S \rightarrow 0T \mid 1T$

$T \rightarrow 0S \mid 1S \mid \epsilon$

Ans 3: String → ababba.

i) Left most Derivation.

$S \rightarrow aB$

$S \rightarrow abS$

$S \rightarrow abaB$

$S \rightarrow ababS$

$S \rightarrow ababbA$

$S \rightarrow ababba.$

ii) Right Most Derivation.

$S \rightarrow aB$

$S \rightarrow abS$

$S \rightarrow abaB$

$S \rightarrow ababS$

$S \rightarrow ababbA$

$S \rightarrow ababba.$

Ans 4: Not possible. Take the language $L = \{aa\}$, having only one string whose length is two. The given grammar can not produce this. Since the grammar can only produce strings of length 1 ~~or~~, 3 and so on. It can not produce strings of length 2.

Scanned by CamScanner

(5) Given grammar $S \rightarrow aAa \mid bBb \mid \epsilon$

$A \rightarrow C \mid a$

$B \rightarrow C \mid b$

$C \rightarrow CDE \mid \epsilon$

$D \rightarrow A \mid B \mid ab$

(i) Eliminating ϵ-productions:-

Nullable symbols in the above grammar are $\{S, C, A, B, D\}$

$S \rightarrow aAa \mid aa \mid bBb \mid bb$

$A \rightarrow C \mid a$

$B \rightarrow C \mid b$

$C \rightarrow CDE \mid DE \mid CE \mid E$

$D \rightarrow A \mid B \mid ab$

(ii) Removing unit productions:-

From the above resultant grammar, we have unit pairs.

(A, A) (A, C) (A, E)

(B, B) (B, C) (B, E)

(C, C) (C, E)

(D, D) (D, A) (D, B) (D, C) (D, E)

Non unit productions.

$S \rightarrow aAa \mid aa \mid bBb \mid bb$

$A \rightarrow a$

$B \rightarrow b$

$C \rightarrow CDE \mid DE \mid CE$

$D \rightarrow a \mid b \mid ab$

+

$A \rightarrow CDE \mid DE \mid CE$

$B \rightarrow CDE \mid DE \mid CE$

$D \rightarrow CDE \mid DE \mid CE$

∴ After removing the unit productions, grammar will have.

$S \rightarrow aAa \mid bBb \mid aa \mid bb$

$A \rightarrow CDE \mid DE \mid CE \mid a$

$B \rightarrow CDE \mid DE \mid CE \mid b$.

$C \rightarrow CDE \mid DE \mid CE$

$D \rightarrow CDE \mid DE \mid CE \mid a \mid b \mid ab$.

Scanned by CamScanner

(iii) Removing useless symbols :-

(i) Find the non-generating symbols :-

$\{a, b, S, A, B, D\}$

and non-generating symbols are = $\{C, E\}$

remove the productions involving C, E in their body.

$S \rightarrow aAa / bBb / aa / bb$

$A \rightarrow a$

$B \rightarrow b$

$D \rightarrow a / b / ab$

(ii) Find unreachable symbols. 'D' is unreachable

So, remove D productions.

the final grammar

$S \rightarrow aAa / bBb / aa / bb$

$A \rightarrow a$

$B \rightarrow b$

Scanned by CamScanner

The resulting grammar will be.

$S \rightarrow aAa \mid bBb \mid aa \mid bb$

$A \rightarrow a$

$B \rightarrow b$

(6) Given grammar G, $S \rightarrow AA \mid SB$

$B \rightarrow AA$

$A \rightarrow a$

(i) given string aaaaa

–				
{S}	{S}			
–	–	–		
{S,B}	{S,B}	{S,B}	{S,B}	
A	A	A	A	A
a	a	a	a	a

for substring aa

A, A

$\Downarrow$

{B, S}

for substring aaa.

a	aa	aa	a
A	{S,B}	{S,B}	A
AS	AB	SA	BA
–	–	–	–

for substring aaaa

a	aaa	aa	aa	aaa	a
A	ϕ	{S,B}	{S,B}	$\{\phi\}$	{A}
–		SS	SB BS BB	–	
		–	S – –		

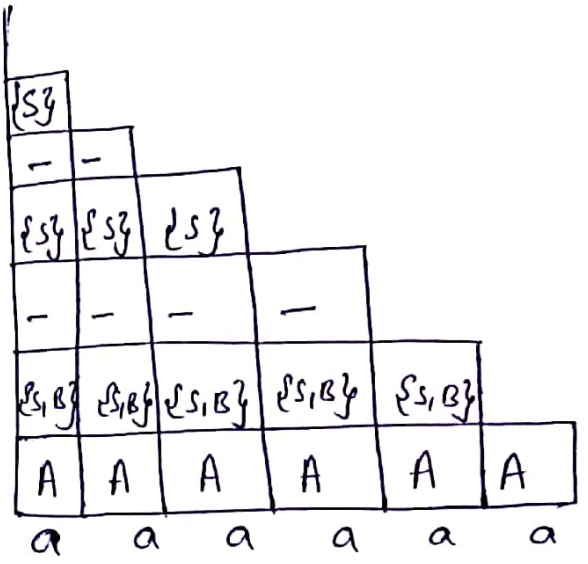
for aaaaa

a	aaaa	aa	aaa	aaa	aa	aaaa	a
A	S	{S,B}	$\{\phi\}$	$\{\phi\}$	{S,B}	S	A
	AS	–		–		SA	

Scanned by CamScanner

∴ The given string a^5 (aaaaa) is not in L(G).

(ii) Given string aaaaaa



for substring aa

A A

{S,B}

for substring aaa

a	aa
A	{S,B}
AS	AB
–	–

aa	a
{S,B}	A
SA	BA
–	–

for substring aaaa

a	aaa
A	{ϕ}
ϕ	
–	

aa	aa
{S,B}	{S,B}
SS	SB BS BB
–	S – –

aaa	a
ϕ	A
ϕ	
–	

for substring aaaaa

a	aaaa
{A}	{S}
AS	
–	

aa	aaa
{S,B}	{ϕ}
S	–
–	

aaa	aa
{ϕ}	{S,B}
–	
–	

aaaa	a
{S}	{A}
SA	
–	

for substring aaaaaa

a	aaaaa
A	ϕ
–	
–	

aa	aaaa
{S,B}	{S}
SS	BS
–	–

aaa	aaa
{ϕ}	{ϕ}
–	
–	

aaaa	aa
{S}	{S,B}
SS	SB
–	S

aaaaa	a
{ϕ}	{A}
–	
–	

Scanned by CamScanner

∴ The given string aaaaaa is in L(G).

Scanned by CamScanner