## **Problem**

Fill out the table described in the polynomial time algorithm for context-free language recognition from Theorem 7.16 for string w = baba and CFG G:

$$S \to RT$$
  
 $R \to TR \mid a$   
 $T \to TR \mid b$ 

## THEOREM 7.16

Every context-free language is a member of P.

## Step-by-step solution

**Step 1** of 3

Table for a string w=baba:

Specified context free grammar (CFG) G follows:

$$S \rightarrow RT$$

$$R \rightarrow TR \mid a$$

$$T \rightarrow TR \mid b$$

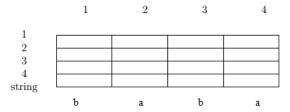
Comment

**Step 2** of 3

Take string w = baba

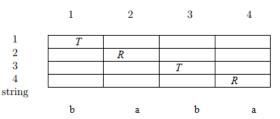
Now we will construct the table for string baba:

Initially the table will be as shown below:



First all the substring string which are having rules of the  $A \rightarrow b$  will be occupied in the location where i =j. As per the theorem.

So the table will be filled as follows:



Now fill the remaining entries of the table such that  $i \leq j$  and substring formed by one or more substring such that rule  $A \to BC$ .

Consider the string ba for its suitable replacement rule.

There is no rule for this string. So the variables of the corresponding individual strings are added to the table entry.

	T	R,T			
		R			
-			T	R	
L				K	
	ь	a	ь	a	
16	e string ab for	r its suitable re	eplacement r	ule.	
ill 1	the next entry	y in the same	row with rule	$S \rightarrow RT$ . Sin	nce it is producing the sting ab.
	1	2	3	4	
	-	-	· ·	*	
	T	R,T			
		R	S		
			T	R	
				- 1	
	ь	a	ь	a	
he	remaining e	ntries of the ta	able are filled	as follows usir	ng the above 2 conditions of the algorithm as the proof for the Theorem 7.16:
	1	2	3	4	
	T	R, T			
		R	S T	R,T	
			1	R	
		•			
	ъ	a	ъ	a	
nt	b	a	b	a	Step 3 of 3
					Step 3 of 3 diagonal is also filled.
two	diagonals a	re filled and us	sing the same $\ 3$	e rules the third	
two	diagonals a	re filled and us	sing the same	e rules the third	
two	diagonals a	re filled and us	sing the same $\ 3$	e rules the third	
two	diagonals a	re filled and us	sing the same	e rules the third	
two	diagonals a	re filled and us  2  R,T R	sing the same	e rules the third  4  R,T  R,T  R,T  R	
	diagonals a	re filled and us	sing the same	e rules the third  4  R,T  R,T  R,T  R	
g	diagonals a	re filled and us  2  R,T R	sing the same	e rules the third  4  R,T R,T R,T R	
two	diagonals at 1 T b	re filled and us  2  R,T R  a  y in the table u	sing the same  3  S S T	e rules the third  4  R,T R,T R  a  ditions mention	d diagonal is also filled.
two	diagonals a	re filled and us  2  R,T R	sing the same	e rules the third  4  R,T R,T R,T R	d diagonal is also filled.
two	diagonals at 1 T b	re filled and us  2  R,T R  a  y in the table us	sing the same  3  S S T  b using the con	e rules the third  4  R,T R,T R  a  ditions mention	d diagonal is also filled.
two	b diagonals and the state of th	re filled and us  2  R,T R  a  y in the table u	sing the same  3  S S T  b using the con 3	e rules the third $4$ $R,T$ $R,T$ $R$ a ditions mention $4$ $S$ $R,T$	d diagonal is also filled.
two	b diagonals and the state of th	re filled and us $ \begin{array}{c c}  & R, T \\ \hline  & R \end{array} $ a  y in the table us $ \begin{array}{c c}  & R, T \\ \hline  & R \end{array} $	sing the same  3  S S T  b using the con 3	e rules the third $4$ $R,T$ $R,T$ $R$ a ditions mention $4$ $S$ $R,T$ $R,T$	d diagonal is also filled.
ng	b diagonals and the state of th	re filled and us $ \begin{array}{c c}  & R, T \\ \hline  & R \end{array} $ a  y in the table us $ \begin{array}{c c}  & R, T \\ \hline  & R \end{array} $	sing the same  3  S S T  b using the con 3	e rules the third $4$ $R,T$ $R,T$ $R$ a ditions mention $4$ $S$ $R,T$	d diagonal is also filled.
two	b diagonals and the state of th	re filled and us $ \begin{array}{c c}  & R, T \\ \hline  & R \end{array} $ a  y in the table us $ \begin{array}{c c}  & R, T \\ \hline  & R \end{array} $	sing the same  3  S S T  b using the con 3	e rules the third $4$ $R,T$ $R,T$ $R$ a ditions mention $4$ $S$ $R,T$ $R,T$	d diagonal is also filled.

1 2 3 4