

Eliminate  $\lambda$ -productions from the following grammar.

1.  $S \rightarrow aA \mid bB \mid \lambda$
2.  $A \rightarrow aa \mid \lambda$
3.  $B \rightarrow aS$

1.  $S \rightarrow aA \mid bB \mid \lambda$

We can see that the production  $S \rightarrow \lambda$  is a  $\lambda$ -production. To eliminate it, we need to remove any occurrence of  $S$  on the right-hand side of other production rules. In this case, we have  $S$  appearing in the rule  $B \rightarrow aS$ . Let's remove this rule:

Revised Rule:  $B \rightarrow a$

The production  $S \rightarrow \lambda$  can now be removed:

Revised Rule:  $S \rightarrow aA \mid bB$

2.  $A \rightarrow aa \mid \lambda$

The production  $A \rightarrow \lambda$  is a  $\lambda$ -production. Since there are no other rules involving  $A$ , we can simply remove it:

Revised Rule:  $A \rightarrow aa$

3.  $B \rightarrow aS$

We have already modified the rule  $B \rightarrow aS$  in the first step. There are no  $\lambda$ -productions left in the grammar.

Final Revised Grammar:

$S \rightarrow aA \mid bB$   
 $A \rightarrow aa$   
 $B \rightarrow a$