

CS 301: Theory of Automata  
Quiz 3  
Fall 2019  
October 24, 2019

**PROBLEM**

Remove all the useless symbols from the following grammar:

S  $\rightarrow$  AC | 0 | 1  
A  $\rightarrow$  AD | 11 | 00  
B  $\rightarrow$  CB | DB | EF | 0  
C  $\rightarrow$  ED | FE  
D  $\rightarrow$  DD | AD  
E  $\rightarrow$  DC | BD | AC | FA | BA  
F  $\rightarrow$  0 | 1

**SOLUTION**

**Step 1**

Identify all the generating symbols. The generating symbols are: {S,A,B,C,E,F}.  
From here we can see that the non-generating symbol is {D}  
Grammar after removing generating symbols:

S  $\rightarrow$  AC | 0 | 1  
A  $\rightarrow$  11 | 00  
B  $\rightarrow$  CB | DB | EF | 0  
C  $\rightarrow$  FE  
E  $\rightarrow$  AC | FA | BA  
F  $\rightarrow$  0 | 1

**Step 2**

Identify all the reachable symbols. The reachable symbols are: {S,A,B,C,E,F}. As no symbol in the above set of productions is non-reachable hence the grammar of step 1 is the final grammar after removing useless symbols.