

## Formal Language and Automata Theory – Hand written Assignment

1. Explain the language generated by the following grammar.

$V = \{S\}$   
 $T = \{ (, ) \}$   
 $P:$   
 $S \rightarrow SS$   
 $S \rightarrow SSS$   
 $S \rightarrow (S)$   
 $S \rightarrow )S($   
 $S \rightarrow \lambda$   
 $S$  is the start symbol.

2. Let  $\Sigma = \{a, b\}$ . Consider a language consists of words that has at-least 3 a's. Draw NFA that accepts the language.
3. Construct a Deterministic Finite state Automata (DFSA) for the set of strings over  $\{a, b\}$  with at least three 'a' and at least two 'b'.
4. Assume  $\Sigma = \{a, b\}$ . Consider a language that accepts all words of length in multiples of 3. Draw a DFSA that accepts this Language.

5. Construct an equivalent CFG without unit productions

$S \rightarrow cBA$   
 $S \rightarrow B$   
 $A \rightarrow cB$   
 $A \rightarrow AbbS$   
 $B \rightarrow aaa$

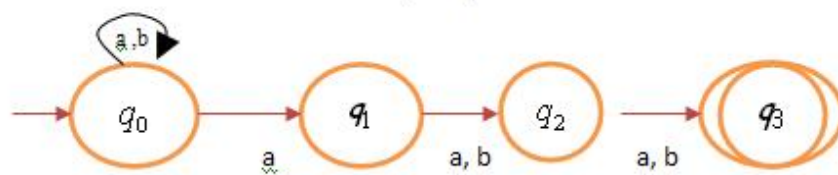
6. Construct an equivalent CFG without  $\lambda$  Productions

$S \rightarrow eSe$   
 $S \rightarrow GH$   
 $G \rightarrow cGb$   
 $G \rightarrow \lambda$   
 $H \rightarrow JHd$   
 $H \rightarrow \lambda$   
 $J \rightarrow bJ$   
 $J \rightarrow f$

7. Construct an equivalent CFG without useless symbols

$S \rightarrow aSASb$   
 $S \rightarrow Saa$   
 $S \rightarrow AA$   
 $A \rightarrow caA$   
 $A \rightarrow Ac$   
 $B \rightarrow bca$   
 $A \rightarrow c$

8. Design a regular grammar for the given regular expression :  $(a+b)c^*(d+(ab)^*)$
9. Consider a language having all words over the alphabet to satisfy each of the following conditions:
- - Third letter of should not be
- Determine the context free grammar for the given language .
10. Construct equivalent Deterministic Finite state Automata (DFA) for the given Non deterministic Finite state Automata (NFA). Comment on it.



11. Explain the Language generated by the given Grammar (G). The production rules for G are  $S \rightarrow aA$  ,  $A \rightarrow aABC \mid bB \mid a$  ,  $B \rightarrow b$  ,  $C \rightarrow c$  and  $S$  is a start symbol.

Choose any string  $w$ , belong to the given Language. For the chosen  $w$ , show left most derivation tree and right most derivation tree.

12. Construct NFA for the given Regular Expression.  $((aa^*)(a+b+c)^*)^*$

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