

# THEORY OF COMPUTATION

## Assignment - 2 Submit by 29th Septemeber 2015

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- Take the alphabet as  $\{a, b\}$  if not specified.
  - Find context-free grammars generating the given language. Explain the logic behind each rule.
  - Construct a Push-down Automaton that recognizes the language
  - Trace your grammar as well as PDA on a typical and atypical example.
  - Each question is allotted to three students, all need to submit their own report.
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1.  $\{w\#x|w^R \text{ is a sustring of } x; w, x \in \{a, b\}^*\}$

2.

$$\{a^i b^j c^k : j = i \text{ or } j = k\}$$

3. The set of strings with twice as many a's as b's.

4.

$$\{a^i b^j c^k : j = i + k\}$$

5.

$$\{a^i b^j c^k : i < j \text{ or } i > k\}$$

6.

$$\{a^i b^j : i \leq 2j\}$$

7.

$$\{a^i b^j : i \leq j \leq 2i\}$$

8. The set of all strings in which every pair of adjacent a's appears before any pair of adjacent b's.

9. The set of all strings whose first two letters match with the last two letters

10. The set of all strings which have even number of a's and odd number of b's.

11.  $W = \{wa^{length(w)} : w \in \{a, b\}^*\}$

12. All strings that end in  $b$  and have an even number of  $b$ 's in total.

**Find the language generated by the rules:**

**Find if the grammar is ambiguous.**

**Construct a PDA that recognizes the language.**

13.  $S \rightarrow AA$   
 $A \rightarrow AAA|a|bA|Ab$

14.  $S \rightarrow aAS|a$   
 $A \rightarrow SbA|SS|ba$

15.  $S \rightarrow aB|bA$   
 $A \rightarrow a|aS|bAA$   
 $B \rightarrow b|bS|aBB$

16.  $S \rightarrow XY$   
 $X \rightarrow XX|a$   
 $Y \rightarrow YY|b$

17.  $S \rightarrow XAX|T$   
 $T \rightarrow aAb|bAa$   
 $A \rightarrow XAX|X|\epsilon$   
 $X \rightarrow a|b$

18.  $S \rightarrow AS|SB$   
 $A \rightarrow BS|SA$   
 $B \rightarrow SS$

19.  $S \rightarrow ASA|aB$   
 $A \rightarrow B|S$   
 $B \rightarrow b|\epsilon$