B.tech. IV Sem (C) (CSE), 2019-20 Examinations,

Theory of Computation, Assignment # 4
(Only for online submission)

April 13, 2020

1. Answer the following in brief:
   (a) degree of ambiguity of a sentence,
   (b) degree of ambiguity as 1,
   (c) bounded ambiguity.
2. Show that following CFGs are ambiguous.
   (a) $S \rightarrow abb \mid bb \mid Sa \mid a$
   (b) $S \rightarrow SaSaS \mid b$
   (c) $S \rightarrow aS \mid abb \mid A$
   (d) $A \rightarrow Aa \mid a$
3. Show that following CFG generates palindrome language and it is unambiguous.

   $S \rightarrow aSa \mid bSb \mid a \mid b \mid \varepsilon$.
4. Show that the class of context-free languages are not closed under the operation of intersection.
5. If L_1 and L_2 are context-free languages, then show that $L_1 \cup L_2$, $L_1 L_2$ are also context-free languages.
6. Given the following grammars, find grammars that do not have left recursive rules, and are equivalent to these grammars.

   $S \rightarrow A \mid B$
   $A \rightarrow aaB \mid Aab \mid Aba$
   $B \rightarrow bB \mid Bb \mid aba$

   Multiple Choice Questions:
7. If the strings of a language L can be effectively enumerated in lexicographic (i.e., alphabetic) order, which of the following statements is true?
   (A) L is necessarily finite
   (B) L is regular but not necessarily finite
   (C) L is context free but not necessarily regular
   (D) L is recursive but not necessarily context free
8. Given the following context free grammar: $G = \{S \rightarrow SS, S \rightarrow ab, S \rightarrow ba, S \rightarrow \varepsilon\}$, consider the the following statements about G:

   I. G is ambiguous
   II. G produces all strings with equal number of a's and b's
   III. G can be accepted by a deterministic PDA.

Which combination below expresses all the true statements about G?
(A) I only
(B) I and III only
(C) II and III only
(D) I, II and III

9. Consider the CFG with $\{S, A, B\}$ as the non-terminal alphabet, $\{a, b\}$ as the terminal alphabet, S as the start symbol and the following set of production rules,

$S \rightarrow aB \mid bA \mid bAA$

$B \rightarrow b \mid bS \mid aBB$

$A \rightarrow a \mid aS$

which of the following string is generated by the above grammar?
(A) *aaaabb* (B) *aabbbb* (C) *aabbab* (D) *abbbba*

Submission deadline: 18-04-2020, 23.59 hrs. The assignment must be hand written on plain paper, then scanned and uploaded in google classroom. On 1st page, write down your name, roll no., class, section, and subject. Every page must be signed at the top. In the absence of these, no awards will be given for the assignment.