IIT Rajasthan
B.Tech. V Sem. 2011
CS340-Exercises # 2 (Topics: CFG, CFL, TM)

1. Suggest the languages generated by the following grammars:

   (a) $S \rightarrow aSa|aBa$, $B \rightarrow bB|b$

   (b) $S \rightarrow abScB|\varepsilon, B \rightarrow bB|b$

2. Find CFG that generates the language:

$$L(G) = \{a^n b^m c^m d^{2n} | n \geq 0, m > 0\}$$

3. Construct $CFGs$ that accept the following languages:

   (a) $\{w|w$ starts and end with same symbol $\}$

   (b) $\{w|\ |w|$ is odd $\}$

   (c) $\{L = a^n b^m c^k | k = n + m\}$

4. Construct a deterministic PDA to accept the language having **binary** strings with twice as many 1's as 0's.

5. Using the pumping Lemma for CFL, show that following language is not Context-free:

$$L = \{a^i b^{2i} a^i | i \geq 0\}$$

6. Construct a TM (of any type) to transform a unary string to binary string. (For example: 11111_1 to 101_2).

7. Is the language

$$\{1^n | n \text{ is prime number } \}$$

   decidable? Suugest the proof for yes/no (which may be formal or logic based).

8. Show that a language L is recursive if-and-only-if L and $\bar{L}$ are *recursive enumerable (RE).*

9. Construct a Turing Machine with $\Sigma = \{a, b\}$, to perform following job:

   Insert a blank beteeen each of the input symbols.

10. Construct a Turing Machine that accepts a language of odd integers written in binary.

11. If L_1 is **R** (Recursive) and L_2 is **RE** (Recursively Enumerable), show that $L_2 - L_1$ is necessarily RE.

12. Show that for a TM M, to decide whether the language $L(M)$ is regular, is undecidable.

Note: The exercises are for practice and not compulssory to submit. However, those who which to submit in lieu of quiz2, may do so as hard copy. The minimum requirement is any 7 exercises from above. The submission must not be later than 21-11-2011. The verbatim answers shall be cancelled..