CS701 – Theory of Computation

Assignment 1

Instructions to Solve Assignments

The purpose of the assignments is to give you hands on practice. It is expected that students will solve the assignments by themselves. Following rules will apply during the evaluation of the assignment.

- Cheating from any source will result in zero marks in the assignment.
- Any student found cheating in any two of the assignments submitted during the course will be awarded "F" grade in the course.
- No assignment after due date will be accepted.

Answer the following questions in your own words. Plagiarism will be checked for each question. Marks will be awarded on the basis of answer and plagiarism report.

Question 1 **(15 + 15 = 30 Marks)**

Design a Turing machine for each of the following languages, give formal description of the TM and draw state diagram.

a) $\{w \mid w$ contains more 0s than 1s over the alphabet $\{0, 1\}\}$. Some example words of the language are as follows:
   a. 00
   b. 01010
   c. 0111000
   d. 1100001

b) $\{a^i b^j c^k \mid i + k \neq j$, and $i, j, k \geq 0\}$. Some example words of the language are as follows:
   a. *a*
   b. *b*
   c. *abbbccc*
   d. *aabbbbbc*

Question 2 **(10 Marks)**

Give Implementation-level description of Turing machine that decide the following language.

$\left\{1^{n^2} \mid n \geq 1\right\}$, the language consisting of all strings of 1s whose length is a square number. Some example words of the language are as follows:
   a. 1
   b. 1111
   c. 111111111
   d. 1111111111111111

Question 3 **(3 + 3 + 4 = 10 marks)**

Read the paper entitled "The Complexity of Theorem-Proving Procedures" and answer the following questions.

a. What is P-reducibility?
b. What is polynomial degree of difficulty?
c. Give an example of elements in the set D_3.

Paper link:
http://www.chell.co.uk/media/product/_master/1/files/cook_complexity_of_theorem_proving_procedures_19712.pdf