**Birla Institute of Technology and Science Pilani**

**First Semester 2012-13**

**CS C351 Theory of computation**

**Take Home Evaluated Tutorial 1**

**Max Marks : 4M**

**Date of Posting : 13th Aug 2012**

**Date of Submission : 14th Aug 2012**

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***Instructions:* Submit a handwritten solution on A4 paper. At the top left hand corner, write your ID and name. On the top right corner write your section number and instructor’s name. Submit to your instructor during the tutorial hour *only.* At the top of the sheet please write the statement ‘*I have worked out this tutorial with my own effort’* and sign underneath. Write only those answers for which marks are indicated, with the correct question number.**

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Consider the set A = {a,b,c}. The elements here are ‘symbols’ using which we can form strings. A string is a sequence of symbols from A, with a definite length. For example, aaba is a string(length=4), aaaa is an another string (again length =4) and so on.

Notationally, aaaa can also be written as a4. bbb can also be written as b3 and so on. aaabbca can be written as a3b2 ca and so on.

Let U be the set of all possible strings that can be formed using symbols from A. (all the length 1 strings, all the length 2 strings, all the length 3 strings and so on).

Let G be a subset of U = set of all those strings in which all three symbols occur equally.

Let F be another subset , consisting of all those strings in which the symbol c follow the symbol b (no b can occur after c)and the symbols b follow the symbols a. (A ‘b’ cannot precede an ‘a’ and a ‘c’ cannot precede a ‘b’ or an ‘a’).’precede’ means to the left of. ‘follow’ means to the right of.

Q1. Give representative members of (i) set G and (ii) set F. If the elements have distinct types, give one example of each type. 0.5M

Q2. What is the intersection of sets F and G (give a description and list a few members). 0.5M

Q3. Give representative members of F-G and G-F. 1M

Consider the set U again. The strings from this set can be ordered (first string, second string and so on). This ordering is done using the notion of ‘lexicographical ordering’. Firstly, the symbols in the set A are arbitrarily ordered. We choose ‘a’ = first symbol, ‘b’ = second symbol and ‘c’ = third symbol. According to this ordering, all strings of length n come before (precede) all strings of length (n+1). Among equal length strings u= u1u2u3u4..un and v= v1v2v3v4..vn (u1,u2…and v1v2…. Stand for the symbols in the string at that position), if u1 precedes v1, then string u precedes string v. If u1 and v1 are the same symbol, then consult the second symbol. If u2<v2 then u <v , if v2<u2 then v<u else consult the next symbol and so on. The first string in U is ‘a’.

Q4. Using this ordering, give the 27th,28th and 29th strings. 1M

Q5. Let A={a,b,c,d} (d being the fourth symbol). Again, list the strings at the same positions. 1M

Using this exercise, convince yourself that the set U is a countably infinite set , for either choice of A. The set of all strings is countably infinite for any finite alphabet (A in our case).

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