Theory of Computation
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Turing machine for User Authentication

Innovative Assignment

Introduction

We have performed simulation of User Authentication using Turing machine. This simulation works similar to any real-world Authentication module.

Here we implemented four types of fields in user authentication module :

1. Username
2. Email ID
3. Password
4. Confirm-Password

Here we considered following notation :

a : lowercase

b : uppercase

c : numbers

d : special character

Reason for choice of this definition

As user authentication is widely used by every real world application or software, which is also an essential in today's world in which people are more concerned about their privacy and data. Making user authentication in Turing machine is much simpler and easy to design. Also we can design our own logic for different fields like username, password and email id and implement it for using different logic based Turing machines.

Approach for the design and simulation

We have designed Turing machines for four types of fields in our module.

1. Username

Username must be of a minimum size 2. It should contain atleast one number and one lowercase character. First we'll find the lowercase characters in string and make it capital then we'll find the numbers in the strings and make it capital. Upon fullfilling the given conditions, the username string will be accepted.

2. Email ID

Email ID is simply made on the basis of the conventional email id regular expression. Which will just accept the current nirma mail id format.

3. Password

Password should contain at-least 2 lowercase, uppercase, numbers and special character. Which must has minimum length of 8. In the first pass from left to right traversal of the string, we'll search for at-least 2 lowercase letters. We'll make it capital as we find them. Then, in the backward pass, we'll search for at-least 2 uppercase letters and make it capital. Next two passes will be the same for numbers and special characters. If all the conditions are full filled then the string will be accepted.

4. Confirm-Password

Confirm password contains two strings (password, re-entered password) separated by delta and surrounded by delta. We'll start by matching the starting character of the first string i.e. password and make it capital and then go to the second string and match the corresponding character. We'll also make it capital if both are same. Then again going back and checking the next character after the capital letter which we just made in previous attempt in first string and doing the same until the whole string is matched and converted in capital and we got the delta again.

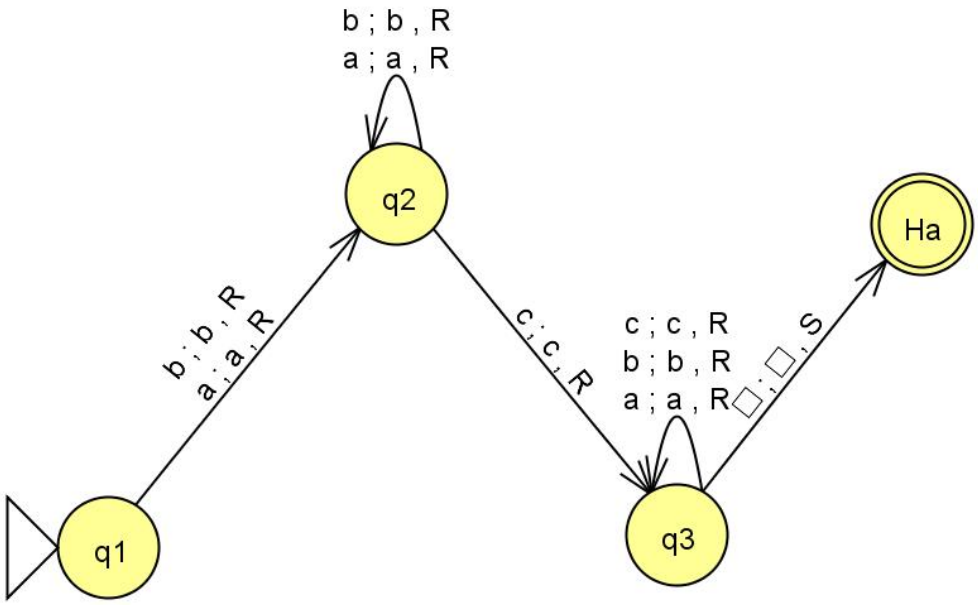
Real life Applications

Turing machines are nearly entirely employed for theoretical work:

If you wish to prove something about a computer's restrictions, establish that it applies to Turing Machines, and fundamentally the same limitation will apply to all computers (e.g. Halting problem, impossibility of certain algorithms).

If you want to demonstrate that a "pseudo-computer" can perform everything a computer can do, all you have to do is show it can simulate a Turing Machine.

1. Turing machine for Username



Username has following characteristics :

- Username should start with uppercase/lowercase letter
- Includes numbers, but not special characters
- Minimum length should be 2 which contains atleast one letter and one number

Sample I/O

- Accepted : abb, ab
- Rejected : bc, ad

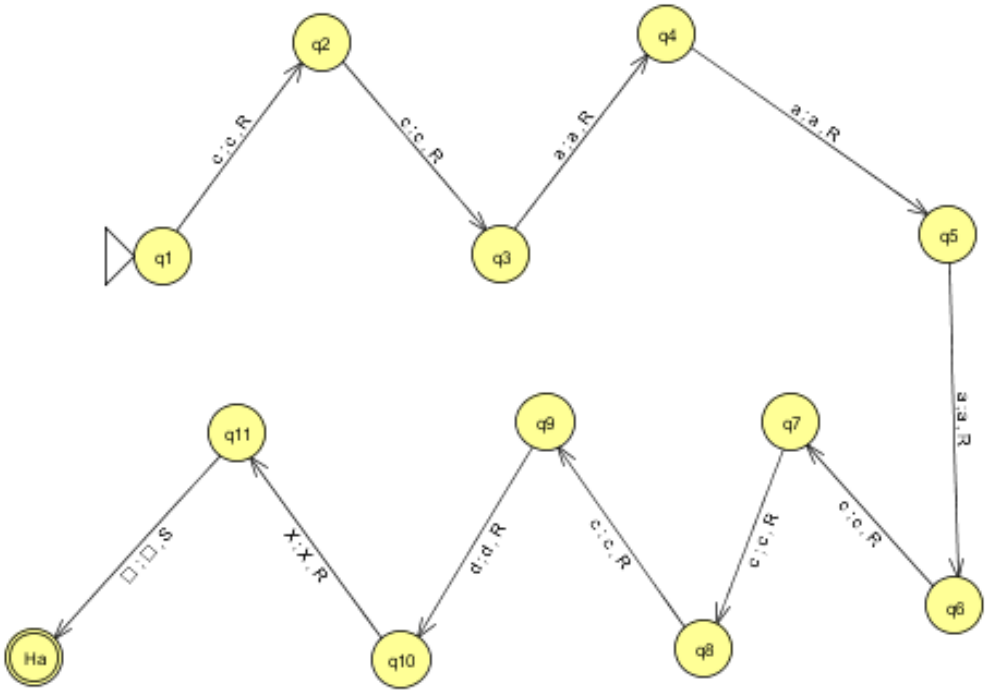
2. Turing machine for Email ID

Email ID has following characteristics :

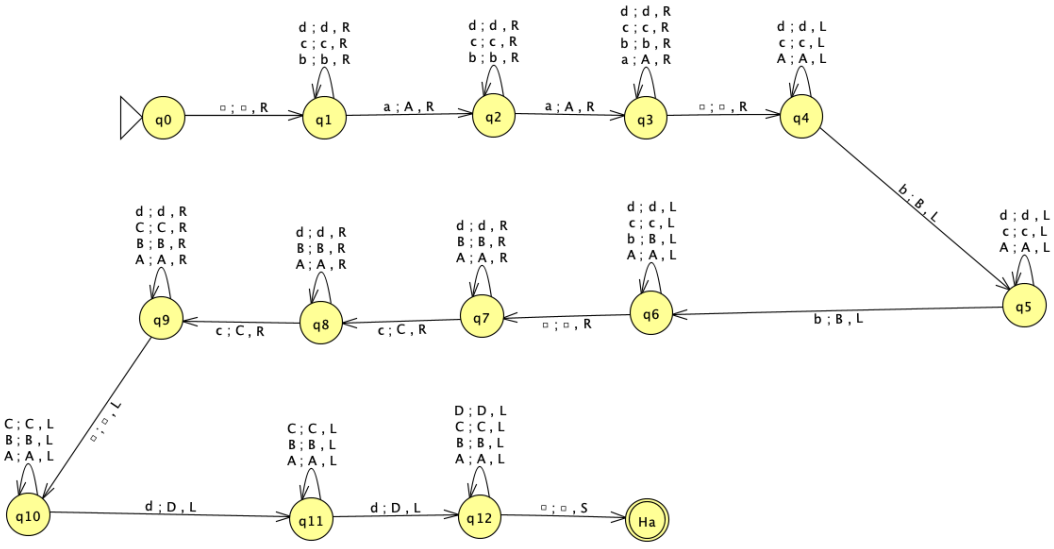
- Consist only lowercase letters and numbers
- Only one @ sign
- Accepted format : DDLLLDDD@nirmauni.ac.in
  - Here D : digit and L : lowercase letter

Sample I/O

- Accepted : ccaaacccdX
- Rejected : aa, abcd, aXd



3. Turing machine for Password



Password has following characteristics :

- It includes atleast :

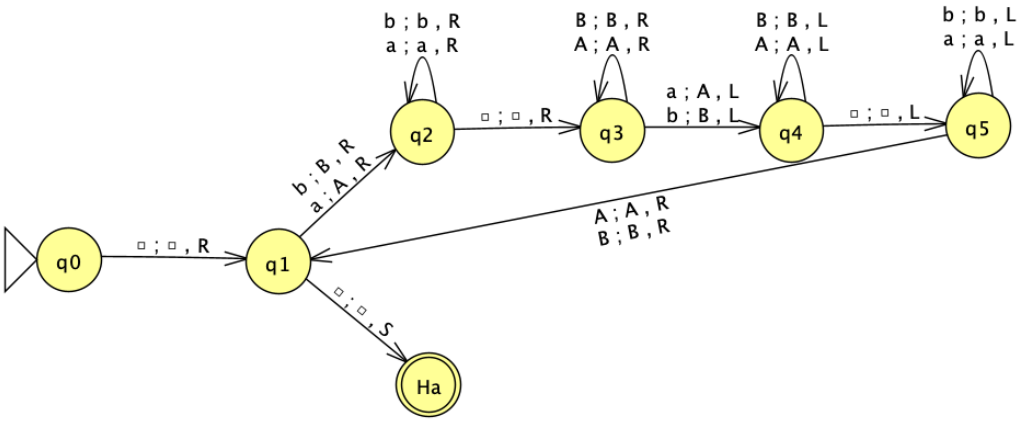
- 2 lowercase letters
- 2 uppercase letters
- 2 special characters
- 2 numbers

• Minimum length : 8 characters

Sample I/O

- Accepted : ▫abcdabcd, ▫aabbccdd, ▫abcdabcdaaa
- Rejected : ▫abcd, ▫aaaa, ▫abcddddd

4. Turing machine for Confirm Password



Confirm-Password has following characteristics :

- Here consider a,b as individual characters this logic will be applied for all lowercase letters, uppercase letters, special characters and numbers.
- Here first word is actual password from password field and the next word will be the confirm password.

Sample I/O

- Accepted : ▫abcdabcd▫abcdabcd▫
- Rejected : ▫abcdabcd▫abcdaaaaa▫

This Turing machine simulated in JFLAP which can be downloaded from here : https://www.jflap.org/jflaptmp/

Rough Diagram plotted in notebook :