The Open University of Sri Lanka

B.Sc. Degree Programme: Level 05
Final Examination- 2008/2009

CSU 3275/PMU 3293/PME 5295 - Automata Theory – Paper I

Duration: Two and Half Hours.

Date: 04.07.2009 10.00 am -12.30 pm

Answer Four Questions Only.

1.

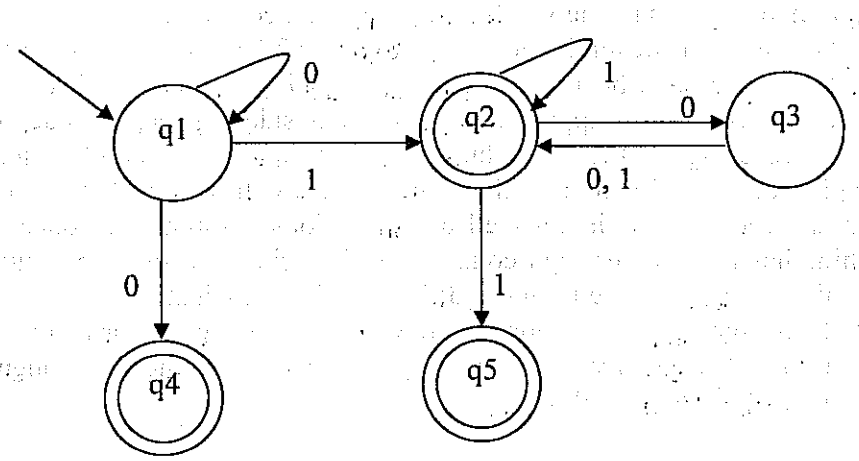
Suppose that a password must start with a letter, must contain at least one digit from 0 to 9, and must contain at least one occurrence of two different special characters, where the special characters are {%, #, &, *}. Thus, MB53&5B#K is an acceptable password, but M46&35&P and 6&P%9 are not acceptable passwords. If you are the system administrator, you need to construct a routine for verifying that the newly proposed passwords meet the requirements. Formally define a deterministic FSM that accepts the set of strings that are acceptable passwords.

i. Define L(M) for the above machine M.
ii. Construct its transition table.

2.

i. What do you mean by implementing a machine? How do we assure that the implementation is true?

ii. Convert the following NDFA into a DFA using subset construction method. Construct the transition diagram of the equivalent DFA.



3.

i. Give the definition of state and output transitions for a Mealy machine.

ii. Let M1, M2, M3 be Mealy machines. Show that M1 $\approx$ M2 and M2 $\approx$ M3 imply M1 $\approx$ M3.

iii. Construct a DFA to accept all the binary strings over {0, 1} having a substring 00 but not ending with 01. Check whether the string '010001' is accepted or not.

4.

i. Suppose M1, M2, and M3 are Mealy machines and that ϕ_1, ϕ_2 are homomorphisms, such that ϕ_1:M1 $\rightarrow$ M2 and, ϕ_2:M2 $\rightarrow$ M3. Prove that $\phi_1.\phi_2$:M1 $\rightarrow$ M3 is a homomorphism, where, $\phi_1.\phi_2 = (\alpha, \sigma, \theta)$ and $\alpha = \alpha 2.\alpha 1, \sigma = \sigma 2.\sigma 1, \theta = \theta 1.\theta 2$.

ii. What do you mean by the statement "two Mealy machines are behaviorally equivalent"?

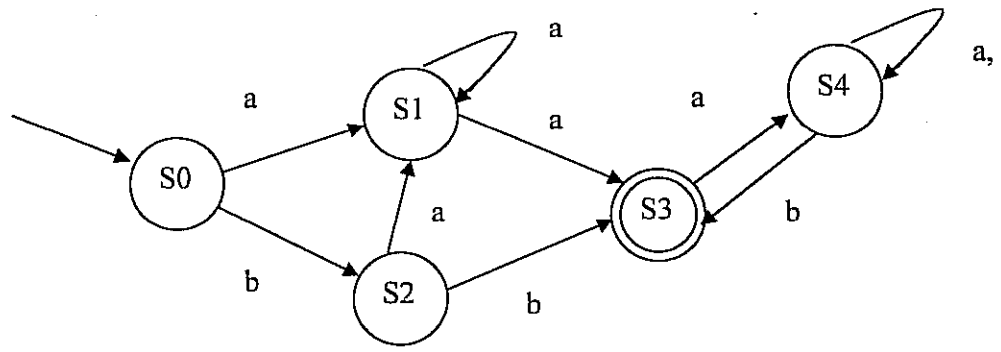
iii. How do two behaviorally equivalent Mealy machines become a weaken homomorphism?

iv. If the α - mapping of the machine in part iii) is given as bijective. Are those two machines identity isomorphism?

5.

i. A certain vending machine vends soft drinks that cost \$0.40. The machine accepts coins in denominations of \$0.05, \$0.10, and \$0.25. When sufficient coins have been deposited, the machine enables a drink to be selected and returns the appropriate change. Considering each coin deposit and the pressing of the vend button as the inputs, construct a state-transition diagram for the machine. The outputs will be signals to vend a drink and return coins in selected denominations. Assume that once the machine has received enough coins to vend a drink, but the vend button has still not been pressed, any additional coins will just be returned in kind. Draw the state transition diagram for the above scenario making assumptions if necessary. How would your machine handle the sequence of coins 0.10, 0.10, 0.10, 0.05, 0.25?

ii. Describe the set of strings recognized by the finite state automaton given below.



6.

i. What do you mean by finite automata?
ii. What are the special characteristics of Deterministic Finite Automata?
iii. "The number of outgoing arcs from a state of a NDFA is always equal to $|\Sigma|$, where $|\Sigma|$ is the number of inputs", Do you agree with this statement? Justify your answer.
iv. Suppose that $\Sigma = \{0, 1\}$. Formally define a finite state machine that accepts the set of strings that contain an even number of 0s and an even number of 1s.