Sequential Machines

Finite automata are limited in the sense that the output is limited to "accept" or "reject". Sequential machines are finite automata in which the output is chosen from an output alphabet, usually denoted Δ.

A *Mealy machine* is a sequential machine in which output is associated with each state transition. (The output of the vending machine example, presented in class, is that of a *Mealy machine*.)

A Mealy machine is a six-tuple $M = (Q, \Sigma, \Delta, \delta, \lambda, q_0)$, where Q is a finite non-empty set of states, Σ is the input alphabet, Δ is the output alphabet, $\delta : Q \times \Sigma \rightarrow Q$ is the state transition function, and $\lambda : Q \times \Sigma \rightarrow \Delta$ is the output function.

The λ function gives the output symbol associated with the transition from state q on input symbol a, i.e., $\lambda(q, a) = z \in \Delta$.

Notice the six-tuple does not have a set of final states. That is because sequential machines do not have final states. (A sequential machine is like the battery-powered bunny: you turn the power on, it starts in the initial state, and it just keeps on running until you turn the power off.)

The length of the output string is equal to the length of the input string. The state transition diagram for a Mealy machine M is almost identical to the diagram for finite automata; the output symbol is denoted on the edge by appending to the input symbol, a slash ("/") followed by the output symbol.

Sequential machines are much more interesting and fun to study since they do produce output! Sequential machines are used to design sequential circuits.