

Comparison between Moore Machine, Mealy Machine, N DFA, and DFA

Aspect	Moore Machine	Mealy Machine	N DFA (Nondeterministic Finite Automaton)	DFA (Deterministic Finite Automaton)
Output Determination	Output depends solely on the current state $\lambda(q)$	Output depends on the current state and the current input $\lambda(q, \Sigma)$	No output, only state transitions	No output, only state transitions
Output Function	$\lambda : Q \rightarrow \Delta$	$\lambda : Q \times \Sigma \rightarrow \Delta$	N/A	N/A
State Transition Function	$\delta : Q \times \Sigma \rightarrow Q$	$\delta : Q \times \Sigma \rightarrow Q$	$\delta : Q \times \Sigma \rightarrow 2^Q$	$\delta : Q \times \Sigma \rightarrow Q$
Number of Transitions	Deterministic: one transition per state per input symbol	Deterministic: one transition per state per input symbol	Nondeterministic: zero, one, or more transitions per state per input symbol	Deterministic: one transition per state per input symbol
Timing of Output	Output is associated with states; output changes only on state change	Output can change immediately with input, not just on state change	N/A	N/A
Output Stability	More stable, as output changes only when the state changes	Less stable, as output can change with every input	N/A	N/A
Implementation Complexity	Simpler, as output is decoupled from input	Slightly more complex due to coupling of output with input	Simpler in conceptual design but can be more complex in implementation	Simpler in implementation but may require more states
Transition Complexity	Simple deterministic transitions	Simple deterministic transitions	Complex nondeterministic transitions	Simple deterministic transitions
Accepting States	N/A	N/A	Defined accepting states	Defined accepting states
Determinism	Deterministic	Deterministic	Nondeterministic	Deterministic
Typical Use Cases	Applications where stable outputs are required, like counters	Applications needing immediate response to inputs, like control circuits	Pattern matching, text processing	Pattern matching, lexical analysis
Example Applications	Digital circuit design, pattern recognition, control systems, text processing	Digital circuit design, pattern recognition, control systems, text processing	Regular expression matching, language recognition	Regular expression matching, language recognition

Summary

- **Moore Machine:** Outputs depend solely on the current state, making them more stable but potentially less responsive.
- **Mealy Machine:** Outputs depend on both the current state and the current input, making them more responsive but potentially less stable.
- **NDFA (Nondeterministic Finite Automaton):** Allows multiple transitions for a given state and input symbol, making it flexible but potentially more complex to implement.
- **DFA (Deterministic Finite Automaton):** Has exactly one transition for each state and input symbol, making it simpler to implement but may require more states compared to an NDFA.