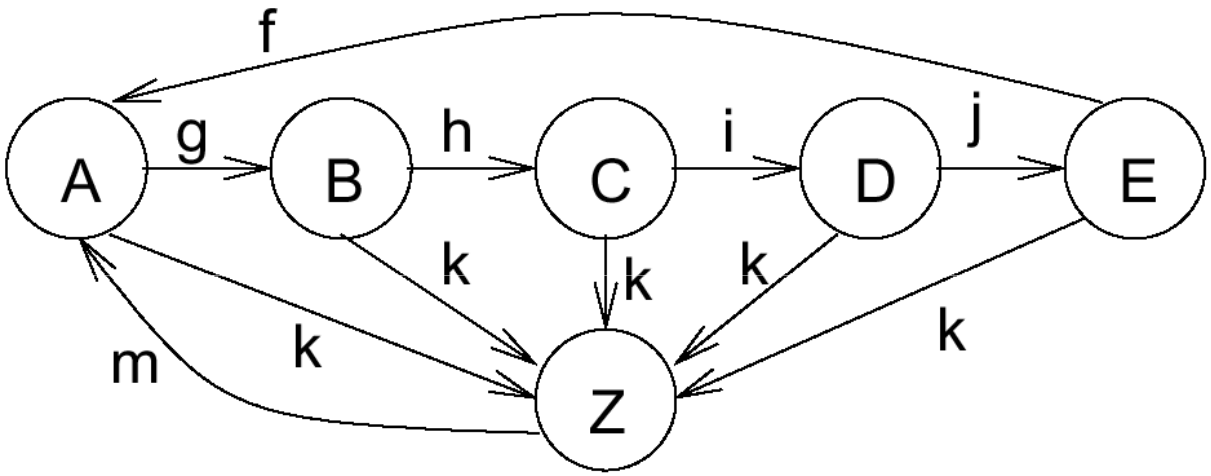
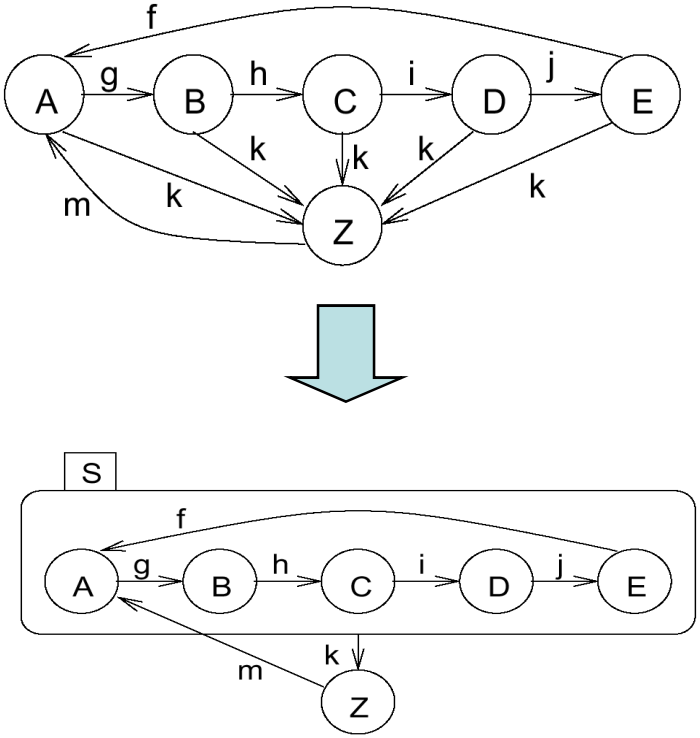
Features of StateCharts

- Nested states and hierarchy
  - Improves scalability and understandability
  - Helps describing preemption
- Concurrency - two or more states can be viewed as simultaneously active
- Nondeterminism - there are properties which are irrelevant

Example FSM

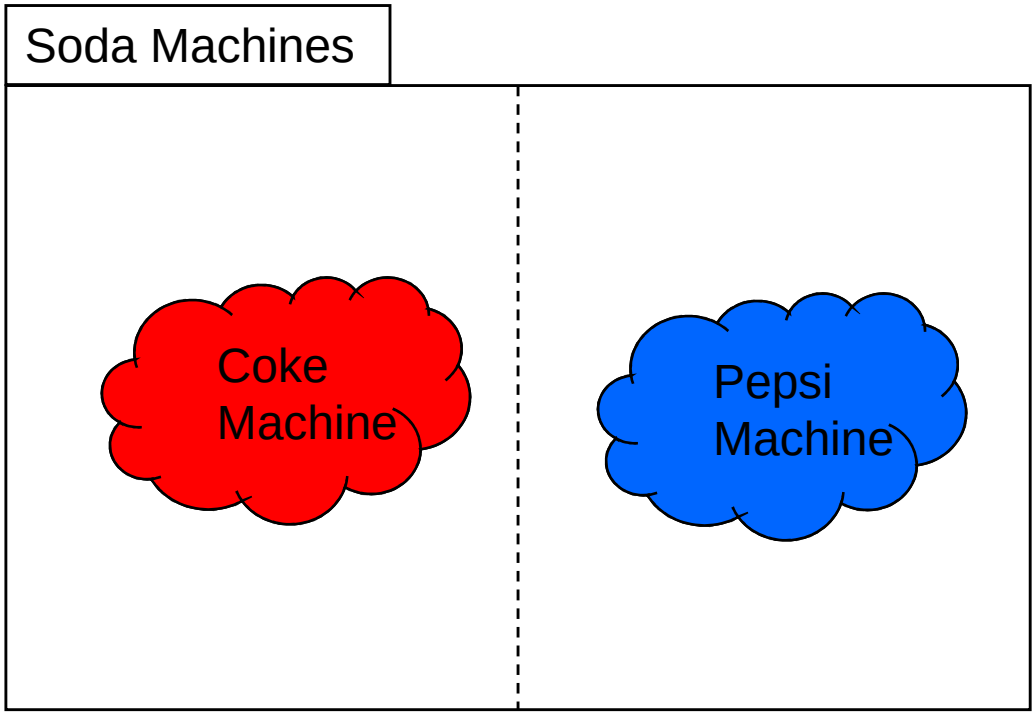


Hierarchy



When FSM is in any sub-states of S, an event k would preempt the FSM to transition to z.

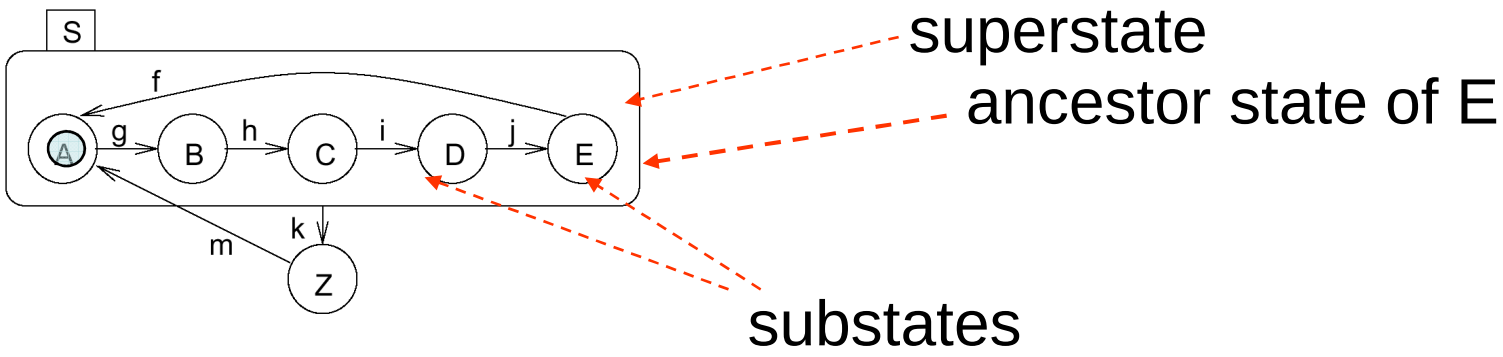
Concurrency



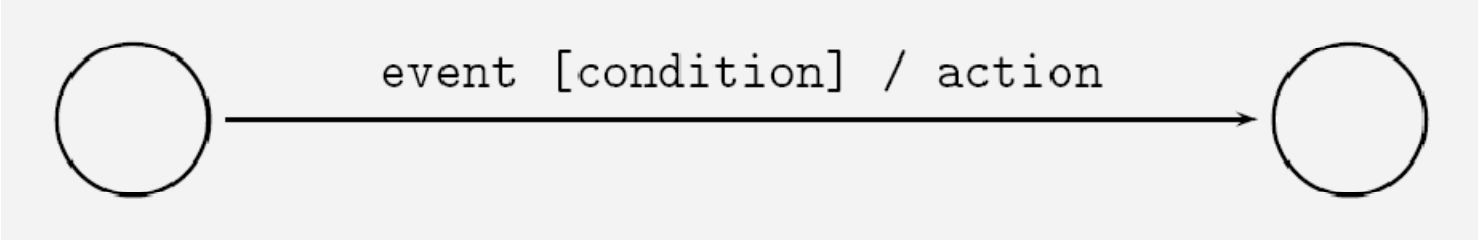
Coke machine and Pepsi machine are simultaneously active. The use of AND state avoids exponential state explosion.

Definitions

- Current states of FSMs are also called **active** states.
- States which are not composed of other states are called **basic states.**
- States containing other states are called **super-states**.
- For each basic state s, the super-states containing s are called **ancestor states**.
- Super-states S are called **OR-super-states**, if exactly one of the sub-states of S is active whenever S is active.



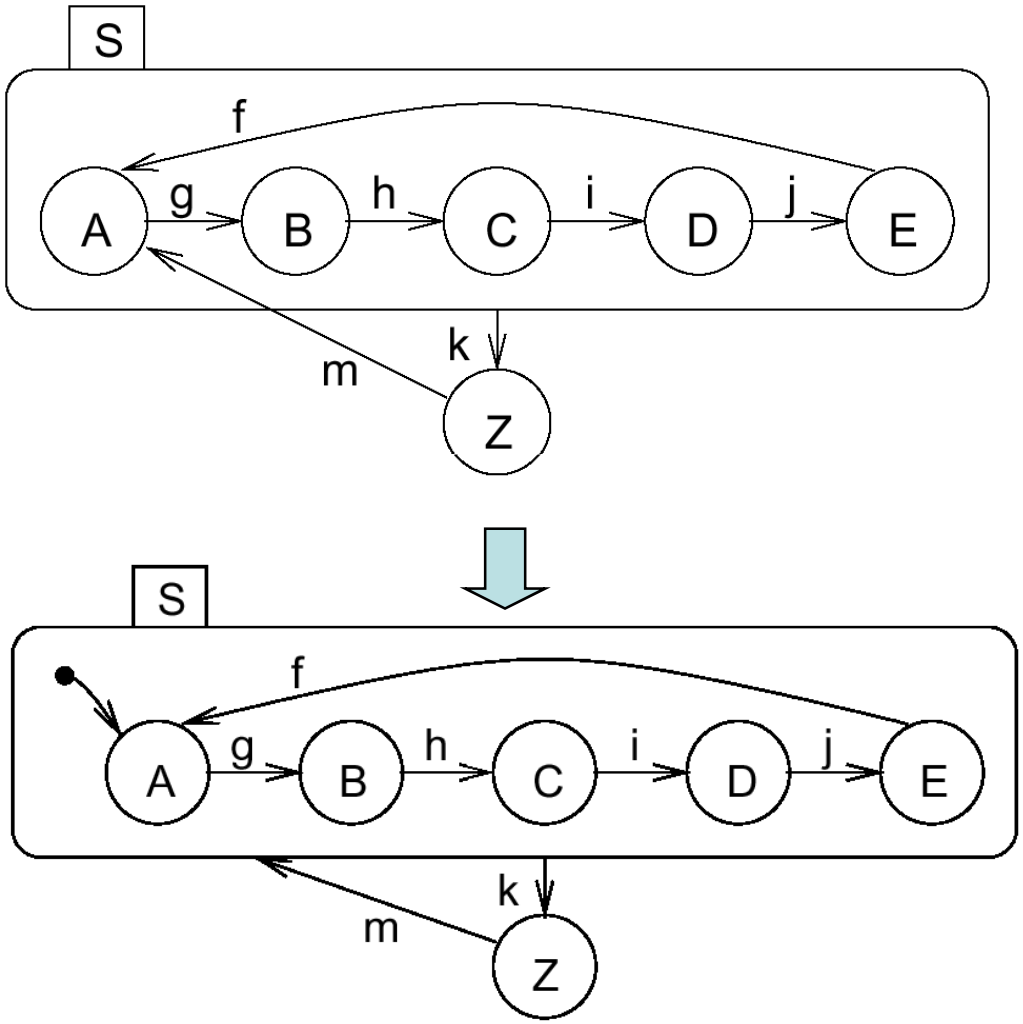
Edge Labels



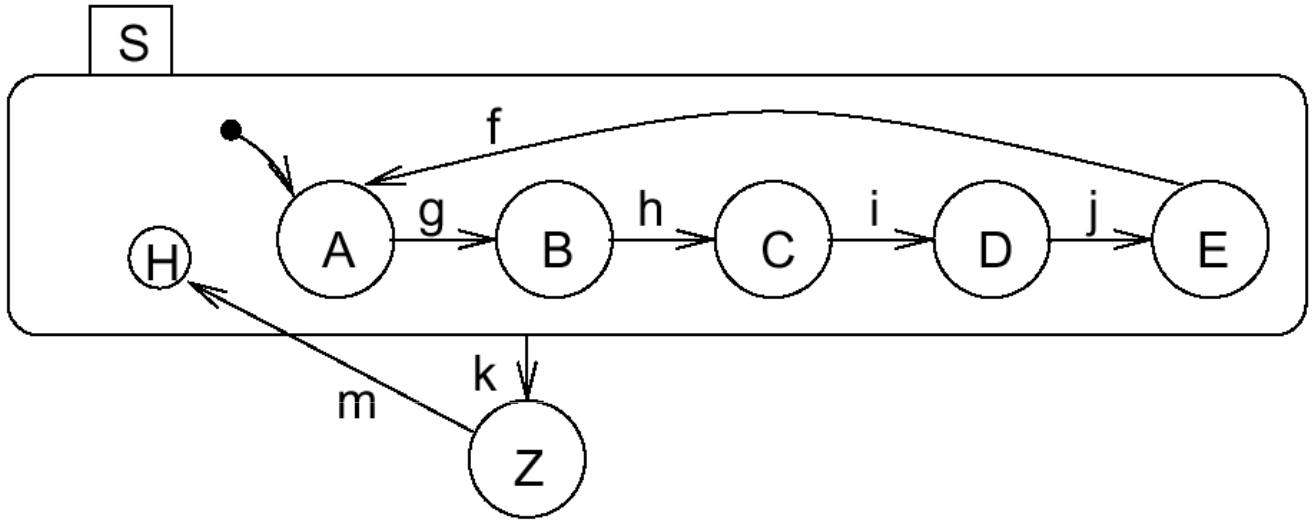
- Transition may be taken if event occurred in the last step and condition is true
- Action is carried out when the transition is taken
- Action performs assignments to variables and generation of events
- Assignments to variables do not take effect until the following step

Default State

- Default state is entered whenever super-state is entered.
- Effectively hides the internal details of a state from external states
- In example, A is the default state of S.



History



• In state Z on input m, FSM enters the state S was in before S was left (can be A, B, C, D, or E). If S is entered for the very first time or history has been cleared, the default state is entered.

STATEMATE Semantics

- Changes in a given step should take effect in the next step
  - Pros: deterministic and simple
  - Cons: induce synchronization overhead for concurrent software simulation

Race Condition

X has value 0 prior to action

Action:

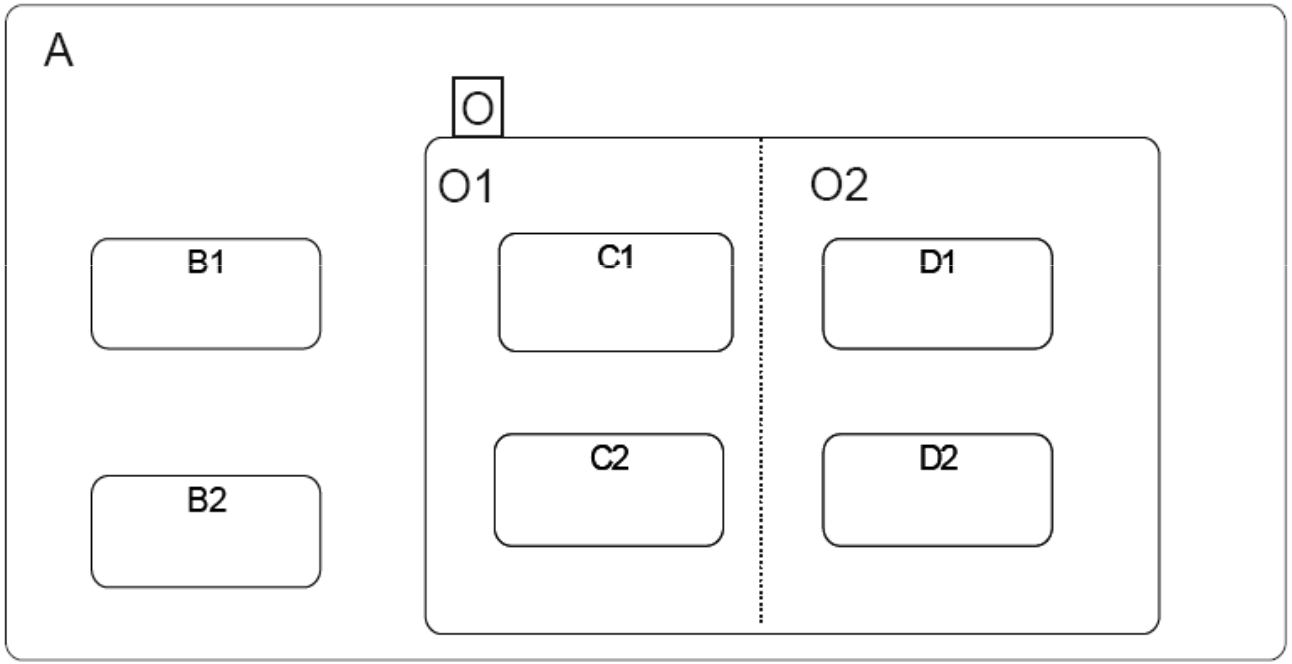
X := X+1; X := X+2

What are the possible values of X after the action is executed?

0 1 2 3

Basic Configuration

A basic configuration is a set of basic states that a system can be put in simultaneously.



Basic configurations are {B1}, {B2}, {C1, D1}, {C1, D2}, {C2, D1}, and {C2, D2}.