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
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.
• 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
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\}. 