

## Embedded Systems and Software Validation

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Ack: A Banerjee for some exercises.

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## Review Concepts

- ▶ Platform model vs. System Model
- ▶ System Architecture vs. System Behavior
- ▶ Criteria for a design model
- ▶ State vs. Transition in the FSM model
- ▶ Limitations of the basic FSM Model
- ▶ Concept of the Unit Step
  - ▶ Basic FSM
  - ▶ Hierarchical FSM
  - ▶ Concurrent FSM
- ▶ Hierarchical vs. Concurrent FSM

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## Review Concepts

- ▶ For a system having  $m$  FSMs each having  $k$  states, what is the number of states in the global FSM?
- ▶ Why is MSC a labeled partial order and not a total order of events?
- ▶ Incomparable events in a MSC
- ▶ Semantics of Synchronous and Asynchronous Concatenation of MSCs

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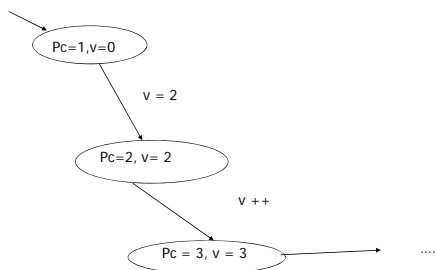
## Exercise 1

Refer to the code fragment below:

- static int v;
  - v = 2;
  - v++;
  - .....
- What are the program states ?
  - How many initial states are there ?
  - Draw the states and transitions corresponding to this program.

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## Exercise1: Solution



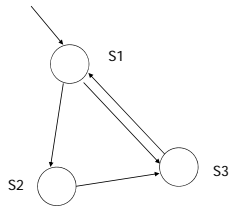
▶ 5

## Exercise2: FSM Modeling: LRT

- ▶ A LRT runs between three stations on the North-South Line (S1, S2, S3). The LRT starts from the station S1 and goes to S3 with or without an intermediate stop at S2 depending on whether there is any passenger or not. From S3, the LRT comes back to S1 directly. Design a FSM to portray the LRT behavior.

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### Exercise2: Solution



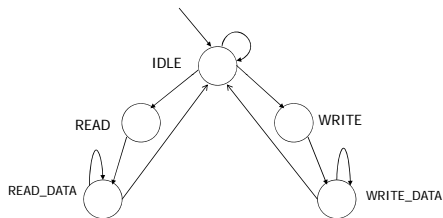
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### Exercise3: FSM Modeling: Transaction Controller

- Design a FSM to model the behavior of an abstract transaction controller. The controller is IDLE as long as a READ or a WRITE instruction does not begin on the bus. On encountering a READ instruction, the controller moves to the READ state, sets a transaction variable as ongoing, and waits for the peripheral to provide the READ data. Once READ is finished, it updates the transaction status to finished and moves back to IDLE state. On encountering a WRITE instruction, the controller has a similar behavior, except for the fact that data is written to the peripheral once the peripheral is ready.

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### Exercise3: One possible Solution



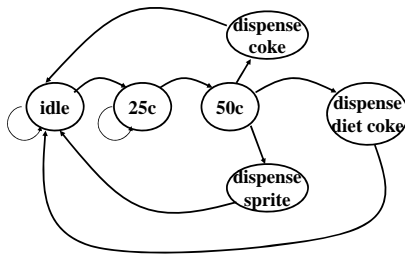
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### Exercise4:

- Design a FSM for an automatic vending machine:
  - When turned on, the machine is idle and waits for money
  - When a quarter is deposited, the machine waits for another quarter
  - When a second quarter is deposited, the machine waits for a selection
  - When the user presses "COKE," a coke is dispensed
  - When the user presses either "SPRITE" or "DIET COKE," a Sprite or a diet Coke is dispensed
  - When the user takes the bottle, the machine moves back to idle state

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### Exercise 4: Solution



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