State Machine Syntax and Semantics
6.005 Elements of Software Construction

### Basic elements

- **A**
- **B**
- **I**

- **S** is a superstate (OR) grouping **A** and **B**
- **S** is a superstate (AND) grouping **A** and **B in parallel**

**Semantics**

- **State machine consists of:**
  - set of states **S**
  - initial state **I** ∈ **S**
  - set of event classes **E**
  - transition relation **R** ⊆ **S**×**E**×**S**

- **Semantics of state machine is:**
  - set of traces **T** ⊆ **E***
  - the empty sequence is a trace **<>** ∈ **T** leading to the initial state
  - if trace **t** can lead to state **s**, and **(s,e,s')** ∈ **R**, then **t^<e>** ∈ **T** is a trace that can lead to state **s'**

- **Parallel combination:**
  - given machines 
    - 
    - **S1, E1, R1, T1** and **S2, E2, R2, T2**
  - a sequence **t** in **(E1∪E2)*** is a trace if **t** restricted to the events in **E1** (**E2**) is in **T1** (**T2**)  

- **Defining a state machine**

  - **Definition should include:**
    - state machine diagram
    - designations of events

  - **Sample designation:**
    - **offhook:** user hangs up phone by pressing END button

### I/O shorthand

- **A**
- **B**
  - **i/o** short for:
  - in state **A**, machine can perform event **i** and then event **o** and end in state **B**