CMU 15-671	Models of Software Systems	Fall 1997

State Machine Basics

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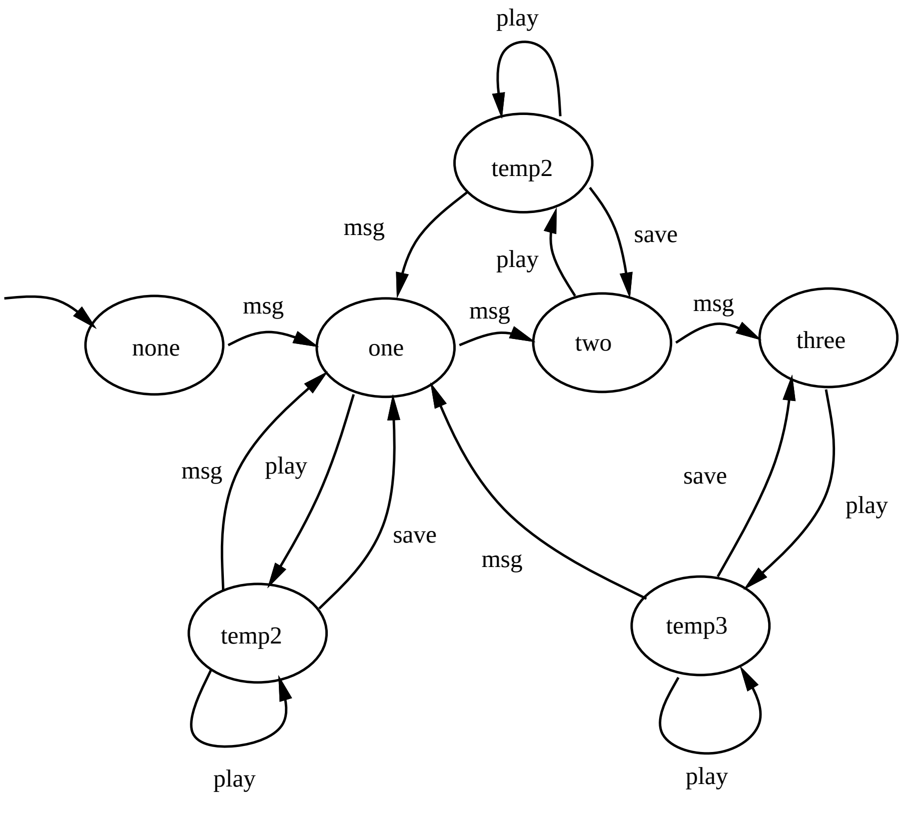
Problem 1.

A certain simple answering machine (not unlike the one on my desk) has two buttons ("play" and "save") and (of course) can receive messages. If someone plays the messages and doesn't save them, they are erased/overwritten when the next incoming message is received. The answering machine only holds a specified number of messages; when it reaches full capacity, it refuses to accept new messages. The answering machine can be modeled by the state machine **AnsMachine** whose state transition diagram is below.



1. Give a 4-tuple description for this state machine.
2. Give three execution fragments of **AnsMachine**, at least one of which is not an execution.
3. Give both a finite and an infinite execution of **AnsMachine**.
4. For each of the following, indicate whether or not it is an event-based trace of **AnsMachine**.
   (a) play save msg msg play
   (b) msg msg msg play save msg msg msg
   (c) msg play save msg msg play msg msg msg
5. Give two examples of state-based traces of **AnsMachine**.
6. Give two sequences of states which are *not* state-based traces of **AnsMachine**.
7. What are the reachable states of this machine?
8. Is **AnsMachine**'s event-based behavior finite or infinite?
9. Can a state machine $M = \langle S, I, A, \delta \rangle$ with an infinite trace have an infinite behavior? Give an example or explain why not.

Problem 2.

Model the Espresso Machine in the MSE Cave. (Or pick some other coffee maker that you have access to.) Write a 4-tuple description and draw out a state transition diagram. Note: pick a level of abstraction that is "reasonably simple".

Intuitively, you, the thirsty customer, are the "environment" of this machine. The machine is the "system". Remember you are modeling the coffee machine and its interactions with the customer. You don't have to model the customer.

So, your set of actions should include things like *putting in coffee*, which changes the state of the machine, and *turning the water flow knob*, which has an effect on the environment (dispensing coffee!) and changes the state of the machine.

According to your state machine description:

1. What happens if there are no water left in the machine?
2. What happens if you forget to get rid of the old coffee before making a new cup?
3. Can you put flavoring in the cup?
4. Is it possible for you to get anything but coffee out of the machine?
5. What if you decide you aren't thirsty?

For each of the above questions, what in the state machine description tells you the answer precisely? Notice, your answer to any of these questions could quite reasonably be "I don't know"; if this is the case, again say what in the state machine description says why that's the answer.