**CS332: Mod02 HW 4**

1. (15 pts) In class we discussed how real world objects such as soda vending machines, airplanes, automobiles, and traffic lights can be modeled as a finite state machine. Provide an example of a real world object or system not discussed in class that can be modeled as a finite state machine. Informally describe the states and transitions. You do not need to explicitly list all of the states (there may be thousands!) but provide a notional idea of the system. You do not need to provide a formal 5-tuple M = {Q, Σ, q0, F, δ}.

Trying to sleep the night before a major exam can be represented with a fairly simple FSM.   
It has the states:  
q0 : trying to sleep

q1 : taking anti-depressants

q2 : unconscious

And the actions one can take in each state can be represented with Σ = { a , b }:

a : failing to sleep

b : falling asleep

Diagram

Description automatically generated The following is a basic sketch of what the FSM may look like…

You start at q0 trying to sleep. From q0 you can fail to sleep (a) which then causes you to transition to the state where you resort to taking anti-depressants to help you sleep (q1).

Ideally, if you were unfortunate enough to reach state q1, you could be affected strongly enough by the pills the first time and succeed in falling to sleep (b), transitioning to q2 where you are unconscious. Otherwise, if you are in q1 and are unlucky enough to fail to sleep (a) even after taking the pills, you will keep taking the pills until you inevitably lose consciousness, ending up in q2.

Or you can be lucky and have the most natural transition where from q0 you can also just fall asleep (b) which then transitions you to the desired state which is unconscious (q2). The goal would be to remain in this state by succeeding to sleep (b). Unfortunately, even from q2 you can fail to sleep (a) by waking up for one reason or another, thus transitioning you back into q0 where you are back at the start, trying to sleep.

1. (5 pts) Draw the machine represented by the 5-tuple M = {Q, Σ, q0, F, δ}

|  |  |  |
| --- | --- | --- |
|  | 0 | 1 |
| 0 | 1 | 2 |
| 1 | 3 | 2 |
| 2 | 1 | 3 |
| 3 | 0 | 0 |

Q = { q0, q1, q2, q3 },

Σ = {1, 0},

q0 = q0 ,

F = { q1, q2},

δ =

A picture containing scissors, tool

Description automatically generated

1. (10 pts) Let Σ  = {a, b}. Draw the machine M for the language L = (ab\*a)+ + (ba\*b)+

Diagram, shape

Description automatically generated

M = { Q , Σ , q0 , F , δ }

Q = { q0 , q1 , q2 , q3 , q4 , q5 }

Σ = { a , b }

q0 = q0

F = { q3 , q5 }

δ =

|  |  |  |
| --- | --- | --- |
|  | a | b |
| 0 | 2 | 4 |
| 1 | 1 | 1 |
| 2 | 3 | 2 |
| 3 | 2 | 1 |
| 4 | 4 | 5 |
| 5 | 1 | 4 |