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, q_0, F, δ}.

Trying to sleep the night before a major exam can be represented with a fairly simple FSM. It has the states:
q_0 : trying to sleep

q_1 : taking anti-depressants

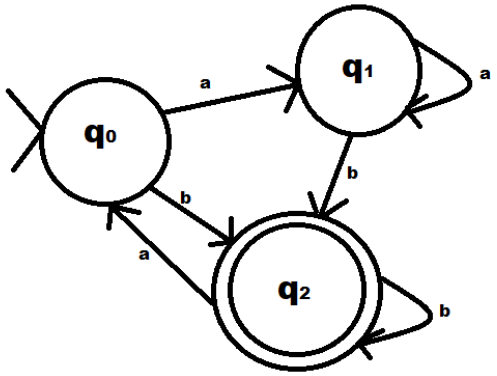
q_2 : unconscious

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

a : failing to sleep

b : falling asleep

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



You start at q_0 trying to sleep. From q_0 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 (q_1).

Ideally, if you were unfortunate enough to reach state q_1, you could be affected strongly enough by the pills the first time and succeed in falling to sleep (b), transitioning to q_2 where you are unconscious. Otherwise, if you are in q_1 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 q_2.

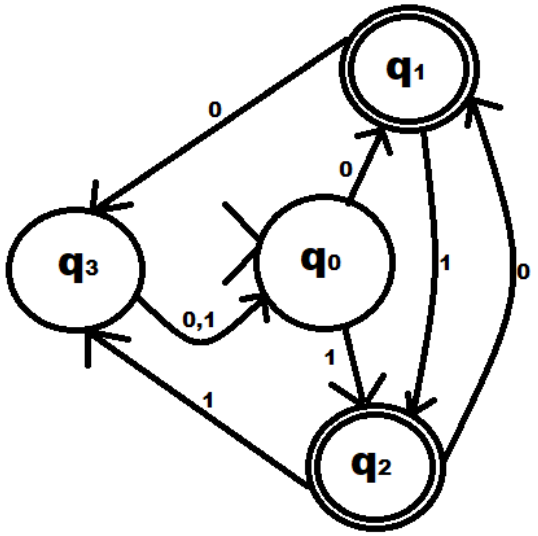
Or you can be lucky and have the most natural transition where from q_0 you can also just fall asleep (b) which then transitions you to the desired state which is unconscious (q_2). The goal would be to remain in this state by succeeding to sleep (b). Unfortunately, even from q_2 you

can fail to sleep (a) by waking up for one reason or another, thus transitioning you back into q_0 where you are back at the start, trying to sleep.

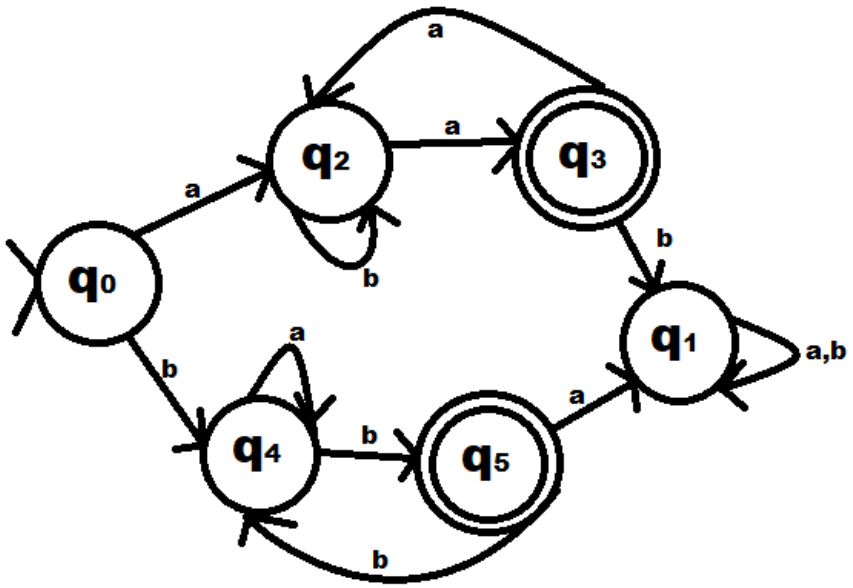
2. (5 pts) Draw the machine represented by the 5-tuple M = {Q, Σ, q_0, F, δ}

Q = { q_0, q_1, q_2, q_3 },
Σ = {1, 0},
q_0 = q_0 ,
F = { q_1, q_2 },
δ =

	0	1
0	1	2
1	3	2
2	1	3
3	0	0



3. (10 pts) Let Σ = {a, b}. Draw the machine M for the language L = $(ab^*a)^+ + (ba^*b)^+$



M = { Q , Σ , q_0 , F , δ }

Q = { q_0 , q_1 , q_2 , q_3 , q_4 , q_5 }

Σ = { a , b }

q_0 = q_0

F = { q_3 , q_5 }

δ =

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