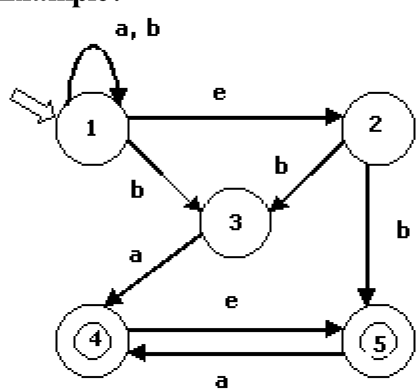
CS341 Automata Theory
TA: Tazeen Siddiqui

Converting NDFSM to DFSM

Compute the following:

1. E(q), epsilon transition of all states
2. s´, new start state
3. δ´, new transitions
4. K´, new states
5. F´, new final states

Example:



Note: e stands for epsilon, you only need to write the blue text in homework or exam answers.

1. E(q)

To calculate epsilon transitions for state q, look for states that are reachable from q with only epsilon transitions. You can always stay in a state on an epsilon transition, so E(q) for q will always include q itself. From state 1, an epsilon leads to state 2. So 2 is going to be included in E(1), if there had been any epsilon transition from 2 to any other state, that would also be included in E(1). From 4, you can reach 5 with an epsilon transition.

q	E(q)
1	{1, 2}
2	{2}
3	{3}
4	{4, 5}
5	{5}

Since we know all the E(q)s, we no longer have to look at the epsilon transitions in the NDFSM.

2. s′ = E(s) = E(1) = {1, 2}

The new start state is going to be {1, 2}

3. δ′

Begin by looking at the new start state, {1, 2} and see where you can go on *a* and *b* transitions.

{**1**, 2}   a

From state 1, an *a* transition leads back to state 1. Check E(1), that gives you 1, 2. From state 1, you can't go anywhere else on an *a*. So far we have

{1, **2**}   a   {1, 2}

Now consider *a* transitions from state 2. You can't go anywhere from state 2 on an *a* transition. Now consider *b* transitions.

{1, 2}   a   {1, 2}
{**1**, 2}   b

From state 1, a *b* transition leads back to state 1, check E(1), that gives you 1, 2. From state 1, a *b* transition leads to state 3, check E(3), that just gives 3. From state 1, you can't go anywhere else on a *b*. So far we have

{1, 2}   a   {1, 2}
{1, **2**}   b   {1, 2, 3}

Now consider *b* transitions from state 2. From state 2, a *b* transition leads to state 3. Check E(3), that just gives 3. From state 2, a *b* transition leads to state 5, check E(5), that just gives 5.

{1, 2}   a   {1, 2}
{1, 2}   b   {1, 2, 3, 5}

Now look at the rightmost column to see if you have any new states. We just took care of {1, 2}. {1, 2, 3, 5} is a new state. Calculate its *a* and *b* transitions in the same way as was done for {1, 2}.

The end result should be:

{1, 2}	a	{1, 2}
{1, 2}	b	{1, 2, 3, 5}
{1, 2, 3, 5}	a	{1, 2, 4, 5}
{1, 2, 3, 5}	b	{1, 2, 3, 5}
{1, 2, 4, 5}	a	{1, 2, 4, 5}
{1, 2, 4, 5}	b	{1, 2, 3, 5}

4. K′

The new states would be the states on the left most column from δ′.

K′ = { {1, 2}, {1, 2, 3, 5}, {1, 2, 4, 5}}

5. F′

The new final states are going to be states from K′ that contain at least one original final state. The original final states were 4 and 5.

So F′ = {{1, 2, 3, 5}, {1, 2, 4, 5}}

You're not required to draw the resulting deterministic finite state machine but here's what it would look like.