Problem Set 9

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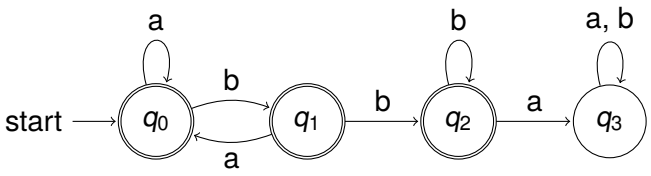
Question 1.

Part a) Give a 4-state DFA that accepts this language L.



The initial state of the DFA is q_0

The accepting states of the DFA are q_0, q_1, and q_2

Part b) Give a proper state invariant for each state of your DFA.

State q_0 - ϵ or A string ending in a which does not contain bba

State q_1 - A string ending with a single b

State q_2 - A string ending with at least two consecutive b's

State q_3 - A string containing the substring bba

Part c) Prove that your DFA has the minimal number of states for accepting L.

Lets pick the following strings:

w_0 = ϵ

w_1 = b

w_2 = bb

w_3 = bba

Pair 1 (w_0 and w_1)

Choose x = ba

w_0x = ba, accepted. w_1x = bba, rejected.

Pair 2 (w_0 and w_2)

Choose x = a

w_0x = a, accepted. w_2x = bba, rejected.

Pair 3 (w_0 and w_3)

Choose x = ϵ

w_0x = ϵ, accepted. w_1x = bba, rejected.

Pair 4 (w_1 and w_2)

Choose x = a

w_1x = ba, accepted. w_2x = bba, rejected.

Pair 5 (w_1 and w_3)

Choose x = ϵ

w_1x = b, accepted. w_3x = bba, rejected.

Pair 6 (w_2 and w_3)

Choose x = ϵ

w_2x = bb, accepted. w_3x = bba, rejected.

$\therefore$ Since no pairs end in the same state, 4 states are needed.

Question 2. Use the subset construction algorithm from lecture to produce an equivalent DFA from the following NFA.

Old State	Symbol	New State	Parent State Number	State Number	New State
$\{q_0\}$	ϵ	$\{q_0, q_4\}$	NA	1	Y
$\{q_0, q_4\}$	0	$\{q_2, q_3\}$	1	2	Y
$\{q_0, q_4\}$	1	$\{q_3\}$	1	3	Y
$\{q_2, q_3\}$	ϵ	$\{q_1, q_2, q_3\}$	2	4	Y
$\{q_2, q_3\}$	0	$\{q_4\}$	2	5	Y
$\{q_2, q_3\}$	1	$\{q_2\}$	2	6	Y
$\{q_3\}$	0	$\{q_4\}$	3	5	N
$\{q_3\}$	1	$\emptyset$	3	NA	N
$\{q_1, q_2, q_3\}$	ϵ	$\{q_1, q_2, q_3\}$	4	4	N
$\{q_1, q_2, q_3\}$	0	$\{q_4\}$	4	5	N
$\{q_1, q_2, q_3\}$	1	$\{q_1, q_2\}$	4	7	Y
$\{q_4\}$	0	$\emptyset$	5	NA	N
$\{q_4\}$	1	$\{q_3\}$	5	3	N
$\{q_2\}$	ϵ	q_1	6	8	Y
$\{q_2\}$	0	$\emptyset$	6	NA	N
$\{q_2\}$	1	$\{q_2\}$	6	6	N
$\{q_1, q_2\}$	ϵ	$\{q_1, q_2, q_3\}$	7	4	N
$\{q_1, q_2\}$	0	$\emptyset$	7	NA	N
$\{q_1, q_2\}$	1	$\{q_1, q_2\}$	7	7	N
$\{q_1\}$	ϵ	q_3	8	3	N
$\{q_1\}$	0	$\emptyset$	8	NA	N
$\{q_1\}$	1	$\{q_1\}$	8	8	N