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Theory of Computation: Worksheet

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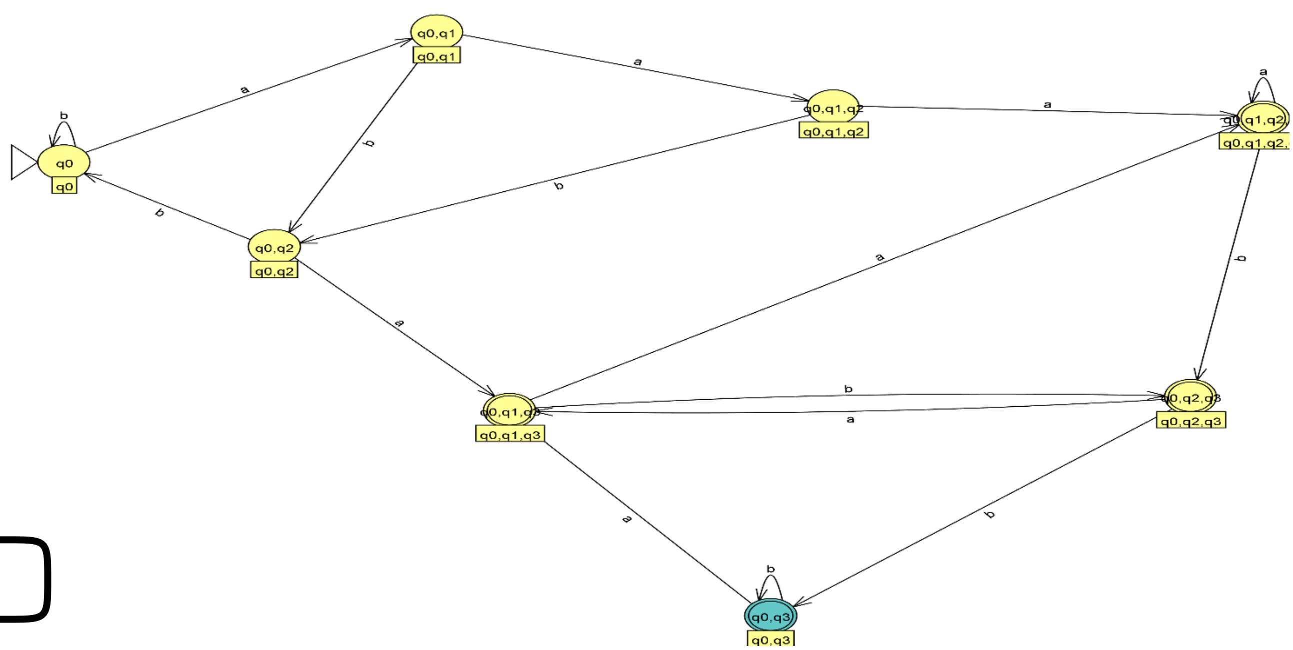
1a.

	A	B
NULL	NULL	NULL
(Start){Q0}	{QO,Q1}	{Q0} ✓
{Q1}	{Q2}	{Q2}
{Q2}	{Q3}	NULL
(Final){Q3}	{Q3}	{Q3}
{Q0,Q1}	{Q0,Q1,Q2}	{Q0,Q2} ✓
{Q0,Q2}	{Q0,Q1,Q3}	{Q0} ✓
{Q0,Q3}	{Q0,Q1,Q3}	{Q0,Q3} ✓
{Q1,Q2}	{Q2,Q3}	{Q2}
{Q1,Q3}	{Q2,Q3}	{Q2,Q3}
{Q2,Q3}	{Q3}	{Q3}
{Q0,Q1,Q2}	{Q0,Q1,Q2,Q3}	{Q0,Q2} ✓
{Q0,Q1,Q3}	{Q0,Q1,Q2,Q3}	{Q0,Q2,Q3} ✓
{Q0,Q2,Q3}	{Q0,Q1,Q3}	{Q0,Q3} ✓
{Q1,Q2,Q3}	{Q2,Q3}	{Q2,Q3}
{Q1,Q2,Q3,Q4}	{Q0,Q1,Q2,Q3}	{Q0,Q2,Q3}✓



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1b.

E({Q2}) = ({Q2,Q3,Q6,Q9,Q12}) ✓

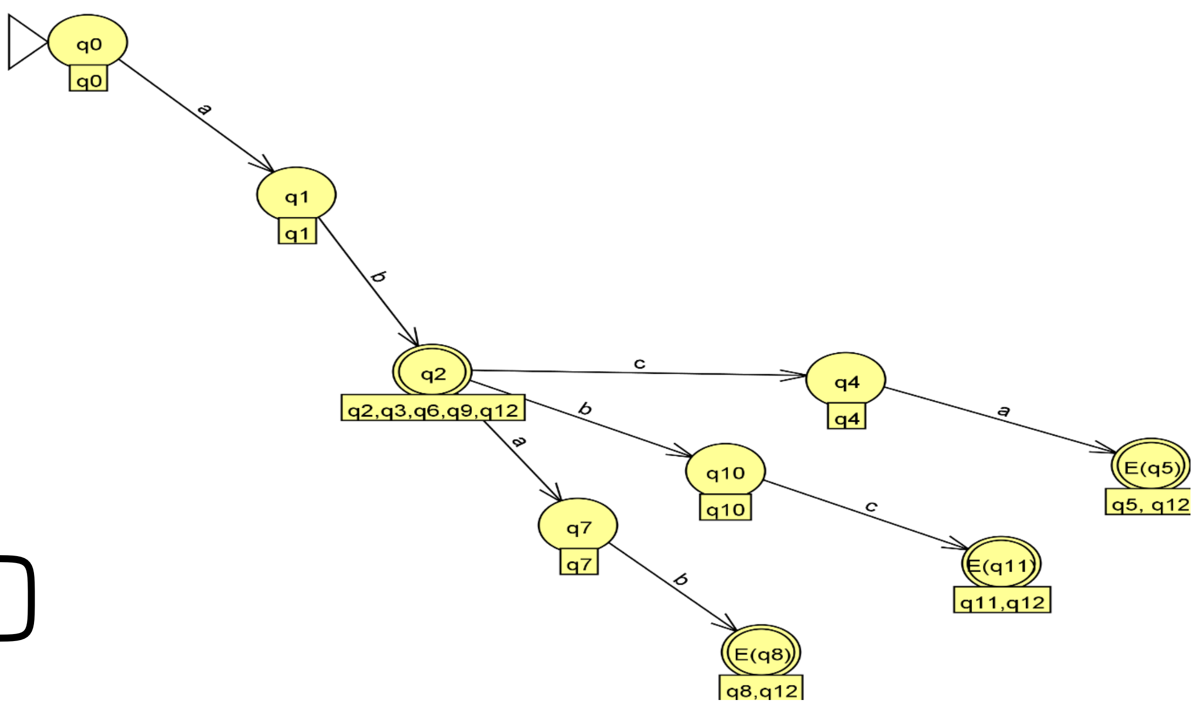
E({Q5}) = ({Q5,Q12}) ✓

E({Q8}) = ({Q8,Q12}) ✓

E({Q11}) = ({Q11,Q12}) ✓

	A	B	C
(Start){Q0}	{Q1}	NULL	NULL
{Q1}	NULL	{Q2,Q3,Q6,Q9,Q12}	NULL
{Q2,Q3,Q6,Q9,Q12}	{Q7}	{Q10}	{Q4}
{Q4}	{Q5,Q12}	NULL	NULL
{Q7}	NULL	{Q8,Q12}	NULL
{Q10}	NULL	NULL	{Q11,Q12}
{Q5,Q12}	NULL	NULL	NULL
{Q8,Q12}	NULL	NULL	NULL
{Q11,Q12}	NULL	NULL	NULL

The null state is unable to reach a final state and is removed



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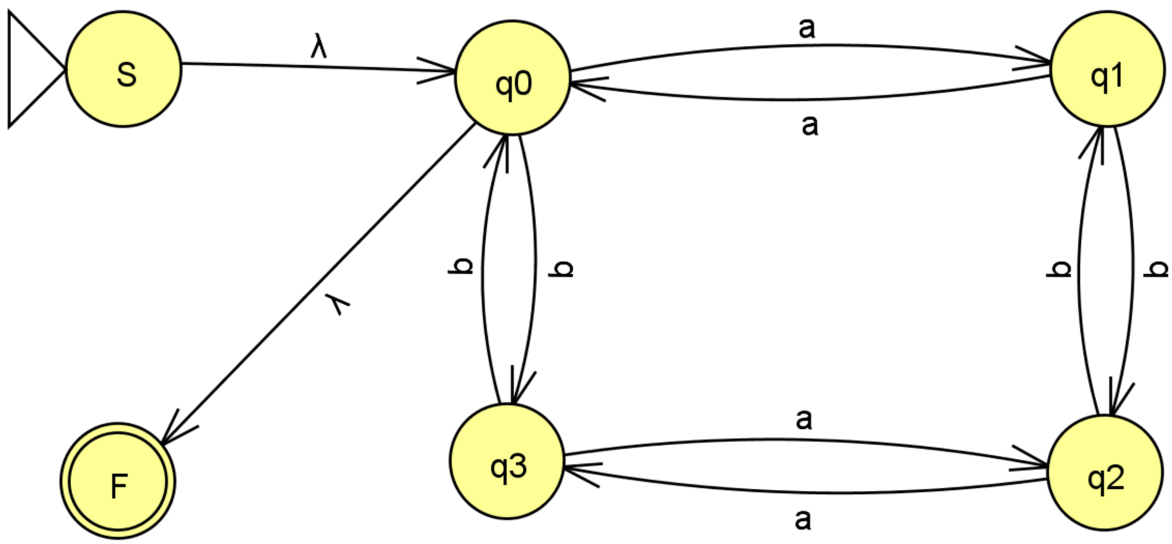
✓

2.

Add new start state and final state



Remove q0	
S-q0-q1➔a	S-q1 ➔a
S-q0-q3➔b	S-q3 ➔b
S-q0-F➔λ	S-F ➔λ
q1-q0-q3➔ba	q1-q3 ➔ba
q3-q0-q1 ➔ab	q3-q1 ➔ab
q1-q0-F ➔a	q1-F ➔a
q1-q0-F ➔b	q3-F ➔b
(q1-q0)* ➔aa	(q1)* ➔aa
(q3-q0)* ➔bb	(q3)* ➔bb

✓

Remove q1	
S-q1-q3➔a(aa)*ab	S-q3 ➔b+a(aa)*ab
S-q1-F➔a(aa)*a	S-F ➔λ+a(aa)*b
q3-q1-F➔ba(aa)*a	q3-F ➔b+ba(aa)*a
(q3-q1)*➔ba(aa)*ab	(q3)* ➔bb+ba(aa)*ab
S-q1-q2 ➔a(aa)*b	S-q2 ➔a(aa)*b
q2-q1-F ➔b(aa)*a	q2-F ➔b(aa)*a
q2-q1-q3 ➔b(aa)*ab	q2-q3 ➔b(aa)*ab
(q2-q1)* ➔b(aa)*b	(q2)* ➔b(aa)*b
q3-q1-q2 ➔ba(aa)*b	q3-q2 ➔ba(aa)*b

Remove q2	
S-q2-F➔a(aa)*b(b(aa)*b)*b(aa)*a	S-F➔λ+a(aa)*a+a(aa)*b(b(aa)*b)*b(aa)*a
S-q2-q3➔ a(aa)*b(b(aa)*b)*a+b(aa)*ab	S-q3➔ b+a(aa)*ab+a(aa)*b(b(aa)*b)*a+b(aa)*ab
q3-q2-F➔ a+ba(aa)*b(b(aa)*b)*b(aa)*a	q3-F➔ b+ba(aa)*a+a+ba(aa)*b(b(aa)*b)*b(aa)*a
(q3-q2)*➔ a+ba(aa)*b(b(aa)*b)*a+b(aa)*ab	(q3)*➔ bb+ba(aa)*ab+a+ba(aa)*b(b(aa)*b)*a+b(aa)*ab

Remove q3	
S-q3-F➔ b+a(aa)*ab+a(aa)*b(b(aa)*b)*a+b(aa)*ab(bb+ba(aa)*ab+a+ba(aa)*b(b(aa)*b)*a+b(aa)*ab)* b+ba(aa)*a+a+ba(aa)*b(b(aa)*b)*b(aa)*a	S-F➔ λ+a(aa)*a+a(aa)*b(b(aa)*b)*b(aa)*a+(b+a(aa)*ab+a(aa)*b(b(aa)*b)*a+b(aa)*ab(bb+ba(aa)*ab+a+ba(aa)*b(b(aa)*b)*a+b(aa)*ab)* b+ba(aa)*a+a+ba(aa)*b(b(aa)*b)*b(aa)*a)

Answer:
λ+a(aa)*a+a(aa)*b(b(aa)*b)*b(aa)*a+(b+a(aa)*ab+a(aa)*b(b(aa)*b)*a+b(aa)*ab(bb+ba(aa)*ab+a+ba(aa)*b(b(aa)*b)*a+b(aa)*ab)* b+ba(aa)*a+a+ba(aa)*b(b(aa)*b)*b(aa)*a)

Please show diagrams
with your steps next time. This is
not easy to follow

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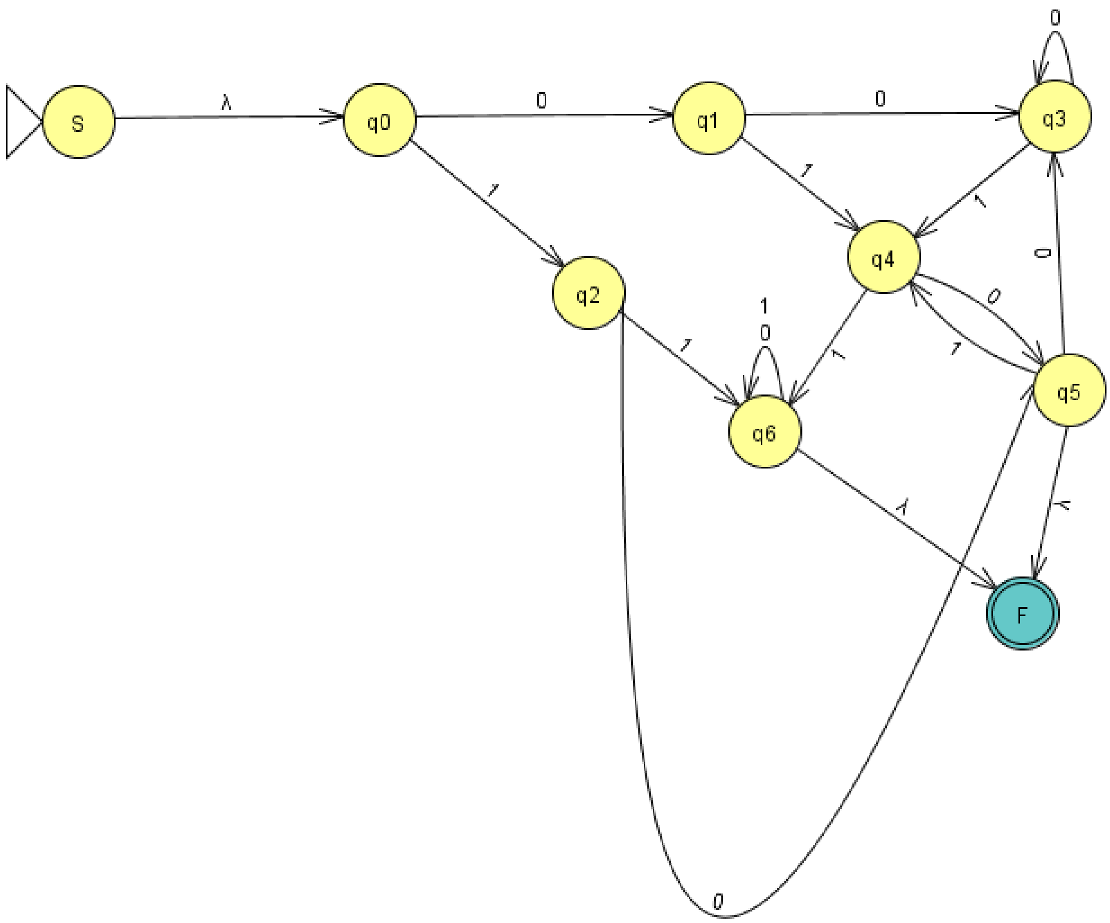
b. Add new start and final state



Remove q0	
S-q0-q1➔0	S-q1 ➔0
S-q0-q2➔1	S-q2 ➔1

✓

Remove q1	
S-q1-q3➔00	S-q3 ➔00
S-q1-q4➔01	S-q4 ➔01

✓

Remove q2	
S-q2-q5➔10	S-q5 ➔10
S-q2-q6➔11	S-q6 ➔11

✓

Remove q3	
S-q3-q4➔000*1	S-q3 ➔01+000*1
q5-q3-q4➔00*1	S-q4 ➔1+00*1

✓

Remove q4	
S-q4-q5➔01+(000*1)0	S-q5➔10+(01+(000*1)0)
S-q4-q6➔01+(000*1)1	S-q6➔11+(01+(000*1)1)
q5-q4-q6➔1+(00*1)1	q5-q6➔1+(00*1)1
(q5-q4)*➔1+(00*1)0	(q5)*➔1+(00*1)0

✓ ✓

Remove q5	
S-q5-F➔ 10+(01+(000*1)0)(1+(00*1)0)*	S-F➔ 10+(01+(000*1)0)(1+(00*1)0)*
S-q5-q6➔ 10+(01+(000*1)0)(1+(00*1)0)*(1+(00*1)1)	S-q6➔ 11+(01+(000*1)1)+(10+(01+(000*1)0)(1+(00*1)0)*(1+(00*1)1))

✓

Remove q6	
S-q6-F➔ 11+(01+(000*1)1)+(10+(01+(000*1)0)(1+(00*1)0)*(1+(00*1)1))(0+1)*	S-F➔ 10+(01+(000*1)0)(1+(00*1)0)*+11+(01+(000*1)1)+(10+(01+(000*1)0)(1+(00*1)0)*(1+(00*1)1))(0+1)*

Answer:
10+(01+(000*1)0)(1+(00*1)0)*+11+(01+(000*1)1)+(10+(01+(000*1)0)(1+(00*1)0)*(1+(00*1)1))(0+1)*

✓

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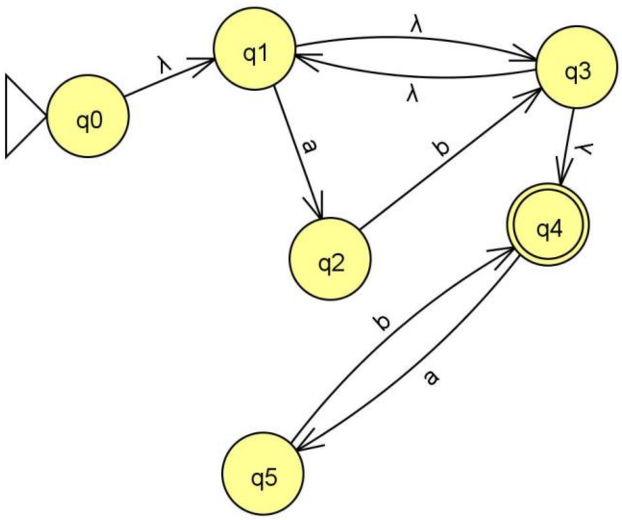
3. RE to DFA

a)



Should be able to start with b

C is mandatory, where is it?

The question said less than 4 states, I count 6

And DFA does not recognize empty symbol

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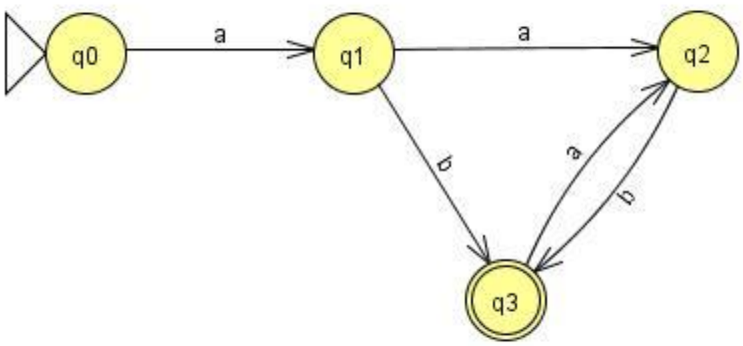
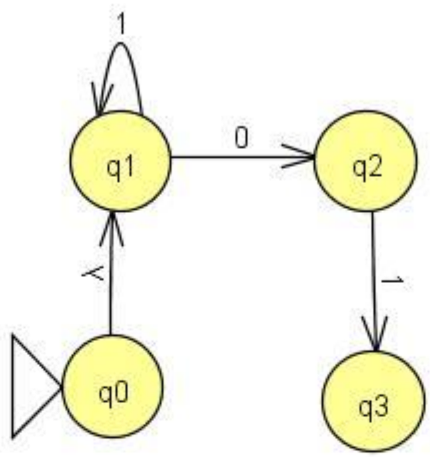


b)



You keep using the empty symbol but you were asked for a DFA

- 0.5

must start with 1 and where is your accept state?

- 1

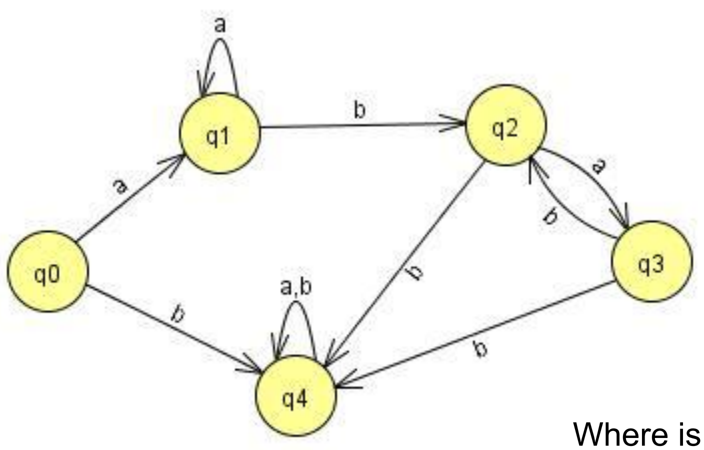
1.5/3

4. DFA Minimization

a)

q0	-	-	-	-	-	-
q1	-	-	-	-	-	X
q2	-	-	-	-	X	X
q3	-	-	-	X	X	X
q4	-	-	Yes	X	X	X
q5	-	X	X	X	X	X
	q5	q4	q3	q2	q1	q0

Minimized Diagram:



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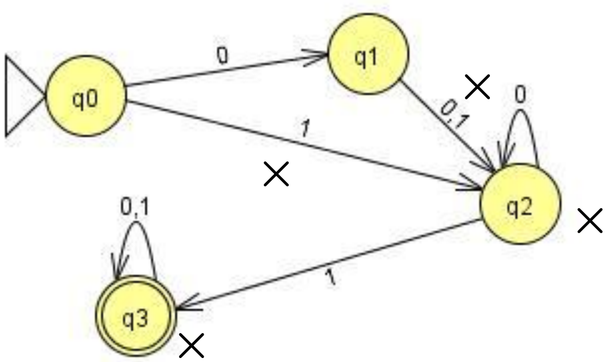
Where is the start and final states?

- 2

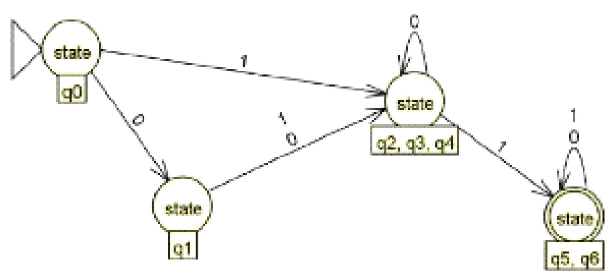
b)

q0	-	-	-	-	-	-	-
q1	-	-	-	-	-	-	X
q2	-	-	-	-	-	X	X
q3	-	-	-	-	YES	X	X
q4	-	-	-	YES	X	X	X
q5	-	-	X	X	X	X	X
q6	-	YES	X	X	X	X	X
	q6	q5	q4	q3	q2	q1	q0

Minimized Diagram:



Answer:



0.5/4

5a. There exists a language where L= {www | w is an element of {0,1}*} is not regular. We will assume that L is a regular language and let p>=1 be the pumping length. A string s of (0^p)(1^p) is established. s∈A and |s| = 2p>=p. Using the Pumping Lemma, s=xyz where y≠e, |xy|<=p and xy^iz ∈ A for all i>=0. Since |xy|<=p, the string y contains only 0s. Since y≠e, y contains at least one 0. Therefore, the string xy^3z=xyyyz contains more 0s than 1s which implies that the string is not contained in L and therefore is a contradiction, L is a not a regular language.

What is this nonsense? where is your pumping length?

The string cannot be 01, it has to be a multiple of 3.

what value did you assign to k? were you absent when I was teaching pumping lemma?

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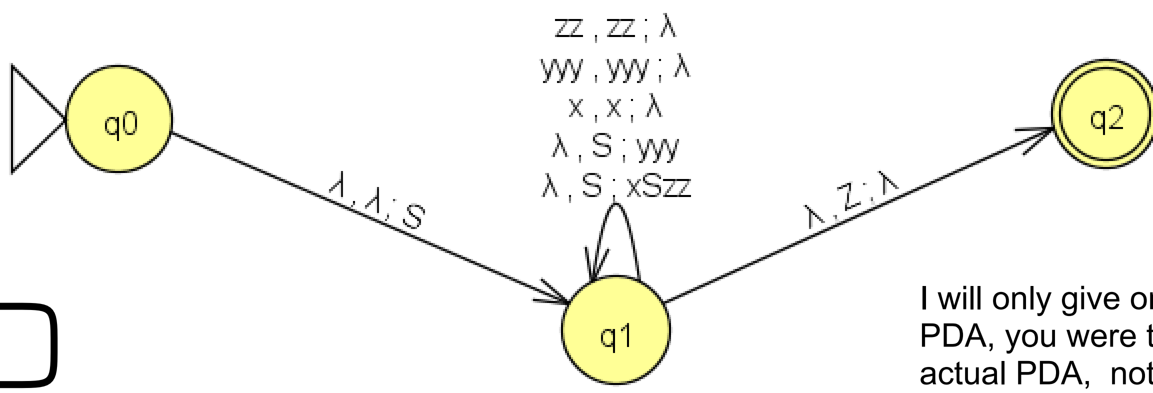
0/5

6a.

S ➔ xSzz|yyy ✓



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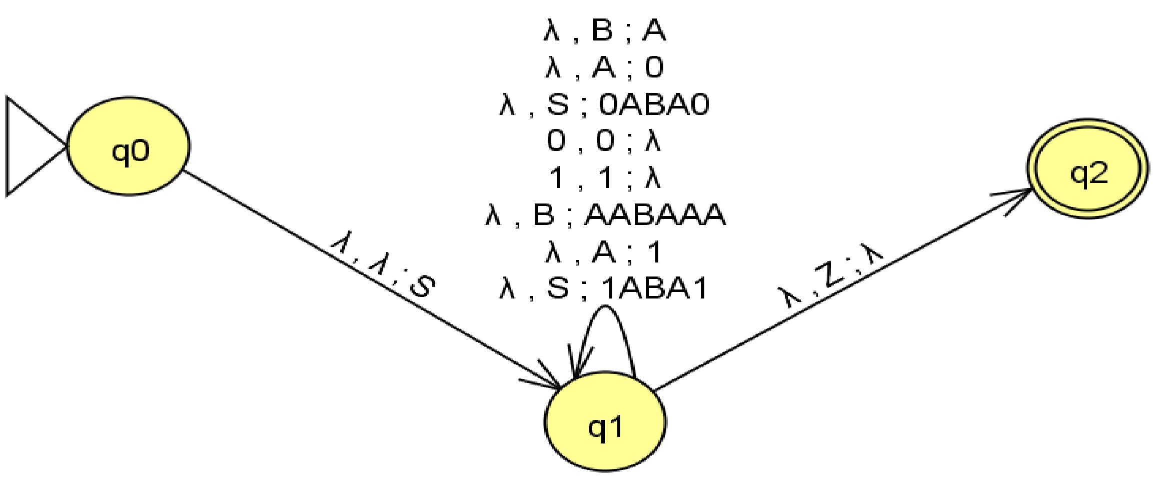
I will only give one mark for PDA, you were to create the actual PDA, not convert CFG to PDA

b.

A➔ 1|0
B ➔ AABAAA|A
S➔ 1ABA1|0ABA0



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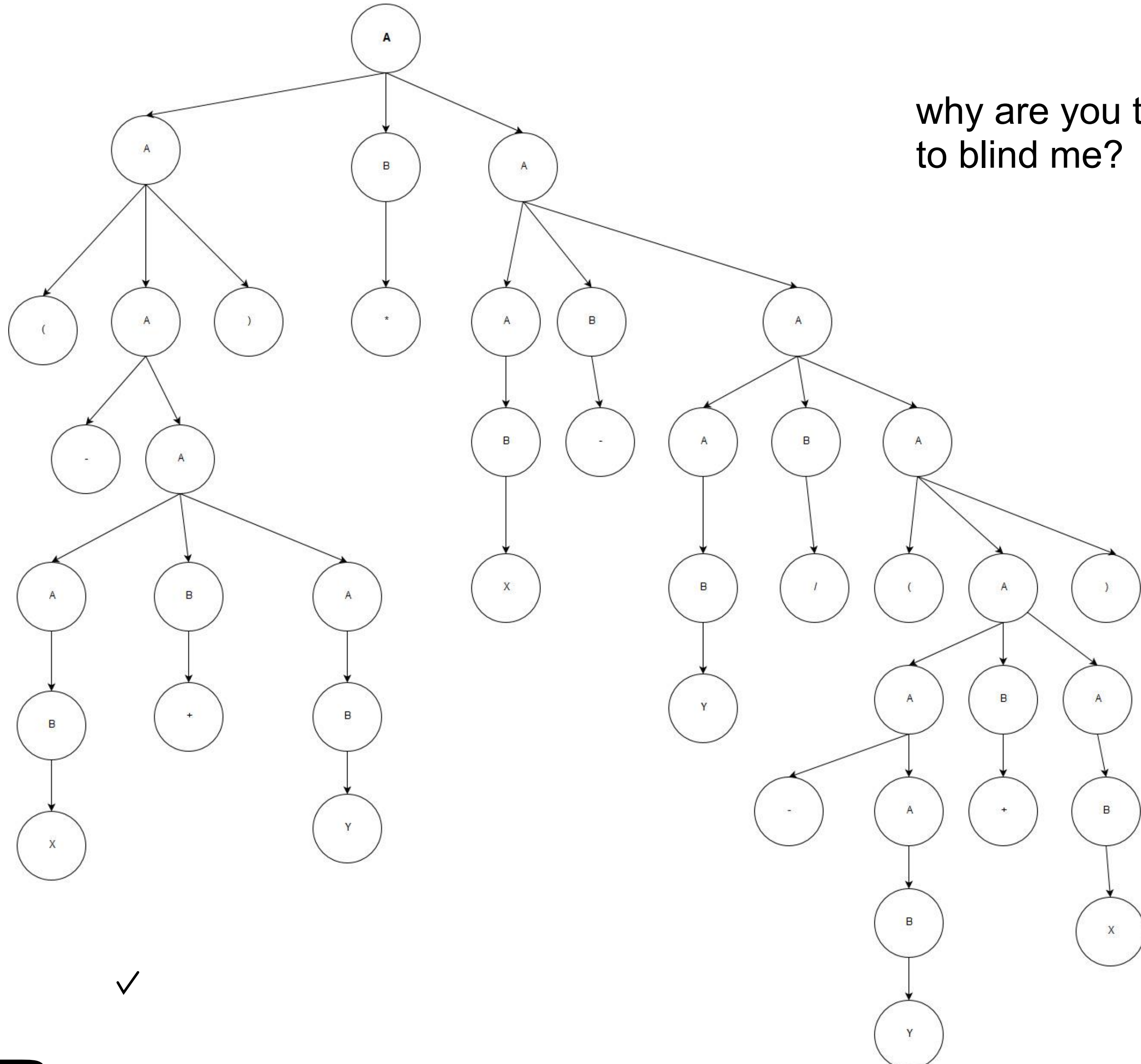
7a.



why are you trying
to blind me?

✓

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b.)

A→ ABA → (A)BA→ (ABA)BA → (BBA)BA→ (YBA)BA → (Y/A)BA→ (Y/B)BA → (Y/Y)BA→ (Y/Y)-ABA →
(Y/Y)-BBA→(Y/Y)-XBA→(Y/Y)-X*A→(Y/Y)-X*(A)→(Y/Y)-X*(-A)→ (Y/Y)-X*(-B)→ (Y/Y)-X*(-Y)

✓

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