CNC 2012
Formal Languages
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Final
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1.) $S \rightarrow AB \mid BCS$
$A \rightarrow aA \mid C$
$B \rightarrow bbB \mid b$
$C \rightarrow cC \mid \lambda$

$S \rightarrow AB \mid B \mid BCS \mid BS$
$A \rightarrow aA \mid C \mid a$
$B \rightarrow bbB \mid b$
$C \rightarrow cC \mid c$

$S \rightarrow AB \mid bbB \mid b \mid BCS \mid BS$
$A \rightarrow aA \mid cC \mid c \mid a$
$B \rightarrow bbB \mid b$
$C \rightarrow cC \mid c$

$S \rightarrow AB \mid B'B'B \mid b \mid BCS \mid BS$
$A \rightarrow A'A \mid C'C \mid c \mid a$
$B \rightarrow B'B'B \mid b$
$C \rightarrow C'C \mid c$
$A' \rightarrow a$
$B' \rightarrow b$
$C' \rightarrow c$

$S \rightarrow AB \mid B'T_1 \mid b \mid BT_2 \mid BS$
$A \rightarrow A'A \mid C'C \mid c \mid a$
$B \rightarrow B'T_1 \mid b$
$C \rightarrow C'C \mid c$
$T_1 \rightarrow B'B$
$T_2 \rightarrow CS$
$A' \rightarrow a$
$B' \rightarrow b$; $C' \rightarrow c$

solution

2.) $S \to A \mid CB$
$A \to c \mid D$
$B \to bB \mid b$
$C \to cC \mid c$
$D \to dD \mid d$

$S \to cC \mid c \mid dD \mid d \mid CB$
$A \to cC \mid c \mid dD \mid d$ ← a cold hand (discard)
$C \to cC \mid c$
$D \to dD \mid d$

$\{B, C, D\}$ all derive terminals ; S derives A (which derives C and D) or CB ; all varicbles are reachable and can terminate.

3.)

$S \to AT \mid AB$
$T \to XB$
$X \to AT \mid AB$
$A \to a$
$B \to b$

a	b	b	b
1	2	3	4

	1	2	3	4
1	A	S,X	T	∅
2		B	∅	∅
3			B	∅
4				B

a	a	b	b	b
1	2	3	4	5

	1	2	3	4	5
1	A	∅	∅	∅	∅
2		A	S,X	T	∅
3			B	∅	∅
4				B	∅
5					B

4.)

$S \to A \mid C$

$A \to \underbrace{A a B}_{u_1} \mid \underbrace{A a C}_{u_2} \mid \underbrace{B}_{v_1} \mid \underbrace{a}_{v_2}$

$B \to \underbrace{B b}_{u} \mid \underbrace{C b}_{v}$

$C \to c C \mid c$

$S \to A \mid C$

$A \to B \mid a \mid B R_1 \mid a R_1$

$R_1 \to a B \mid a C \mid a B R_1 \mid a C R_1$

$B \to C b \mid C b R_2$

$R_2 \to b \mid b R_2$

5.)

$S \to A B$

$A \to B B \mid C C$

$B \to A D \mid C A$

$C \to a$

$D \to b$

$S \to A B$

$A \to B B \mid a a$

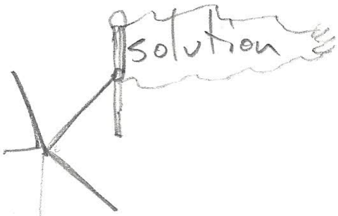
$B \to A b \mid a A \Rightarrow B \to \underbrace{B B b}_{u} \mid \underbrace{a a b}_{v} \mid \underbrace{a A}_{v_2}$

$S \to A B$

$A \to B B \mid a a$

$B \to a a b \mid a a b R_1 \mid a A \mid a A R_1$

$R_1 \to B b \mid B b R_1$



$S \to a a b B B \mid a a b R_1 B B \mid a A B B \mid a A R_1 B B \mid a a B$

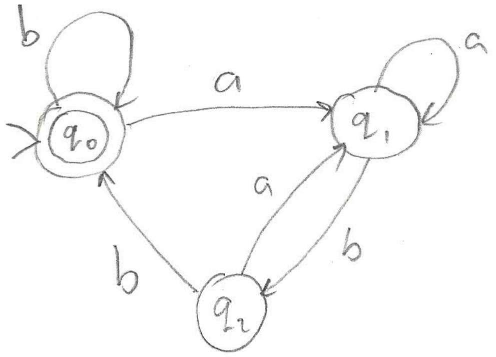
$A \to a a b B \mid a a b R_1 B \mid a A B \mid a A R_1 B \mid a a$

$B \to a a b \mid a a b R_1 \mid a A \mid a A R_1$

$R_1 \to a a b b \mid a a b R_1 b \mid a A b \mid a A R_1 b$

$R_1 \to a a b b R_1 \mid a a b R_1 b R_1 \mid a A b R_1 \mid a A R_1 b R_1$

6.)



a.)

b.)

$[q_0, babaab]$
$\vdash [q_0, abaab]$
$\vdash [q_1, baab]$
$\vdash [q_2, aab]$
$\vdash [q_1, ab]$
$\vdash [q_1, b]$
$\vdash [q_2, \lambda]$

does not accept

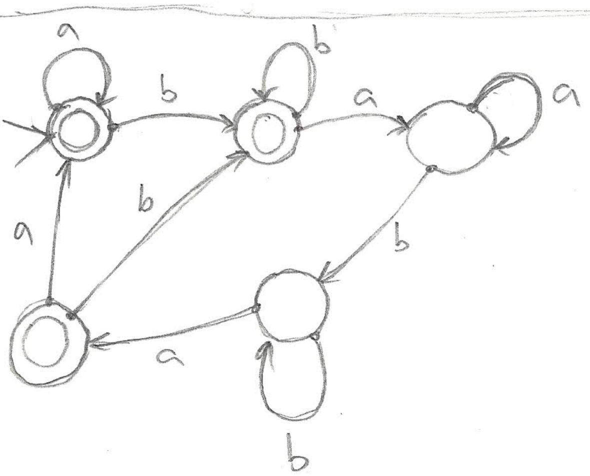
c.) $(b^*aa^*b(aa^*b)^*b)^*(b|aa^*b(aa^*b)^*b)^*$: for $q_0 = F$

	paths to q_i	simple cycles
q_0	$b^*aa^*b(aa^*b)^*b$	$b,\ aa^*b(aa^*b)^*b$
q_1	b^*a	$a,\ b(aa^*b)^*bb^*a$

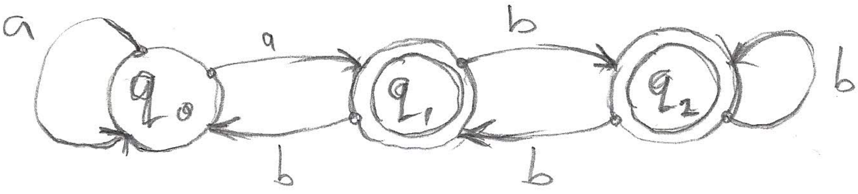
d.) $\left.\begin{array}{l} b^*aa^*b(aa^*b)^*b(b|aa^*b(aa^*b)^*b)^* \,| \\ b^*a(a|b(aa^*b)^*bb^*a)^* \end{array}\right\}$ for $\{q_0 \,\&\, q_1\} = F$

-What are the odds this is wrong? ..

7.)



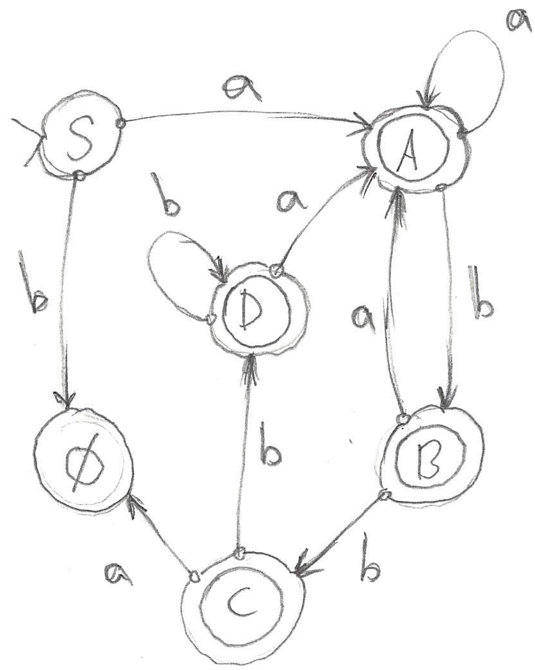
8.)



a.

δ	a	b
q_0	$\{q_0, q_1\}$	$\emptyset$
q_1	$\emptyset$	$\{q_0, q_2\}$
q_2	$\emptyset$	$\{q_2, q_1\}$

no λ transitions means t-table is same as δ-table



e.

$S: \{q_0\}$

$A: \{q_0, q_1\}$

$B: \{q_0, q_2\}$

$C: \{q_2, q_1\}$

$D: \{q_0, q_1, q_2\}$

$\emptyset: \{\}$

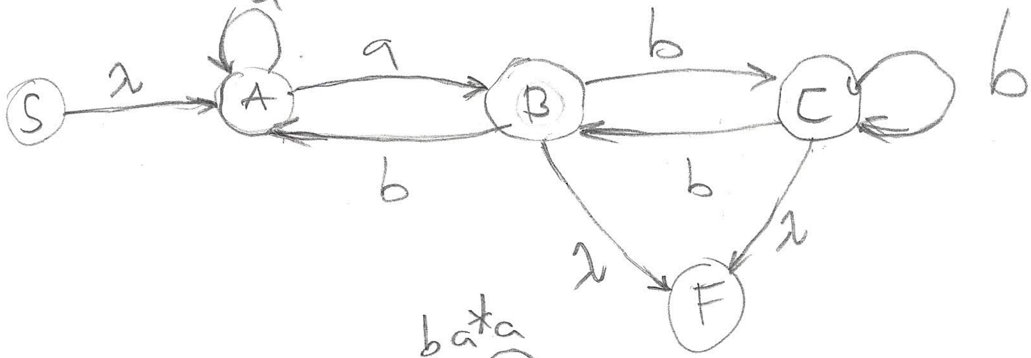
$[q_0, aabb]$

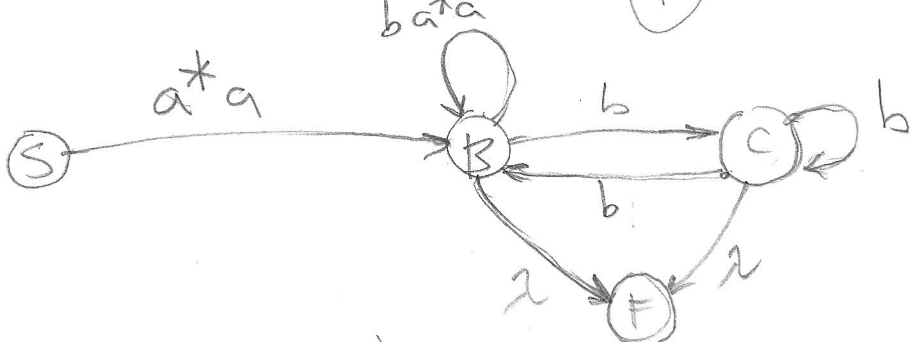
$\vdash [q_0, abb]$ $\quad$ $\vdash [q_1, abb]$ $\quad$ b.

$\vdash [q_0, bb]$ $\quad$ $\vdash [q_1, bb]$

$\vdash [q_0, b]$ $\quad$ $\vdash [q_2, b]$

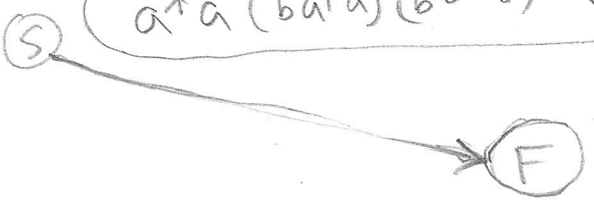
$\{\vdash [q_2, \lambda] \cdot \vdash [q_1, \lambda]\}$ both accepting $\quad$ c.



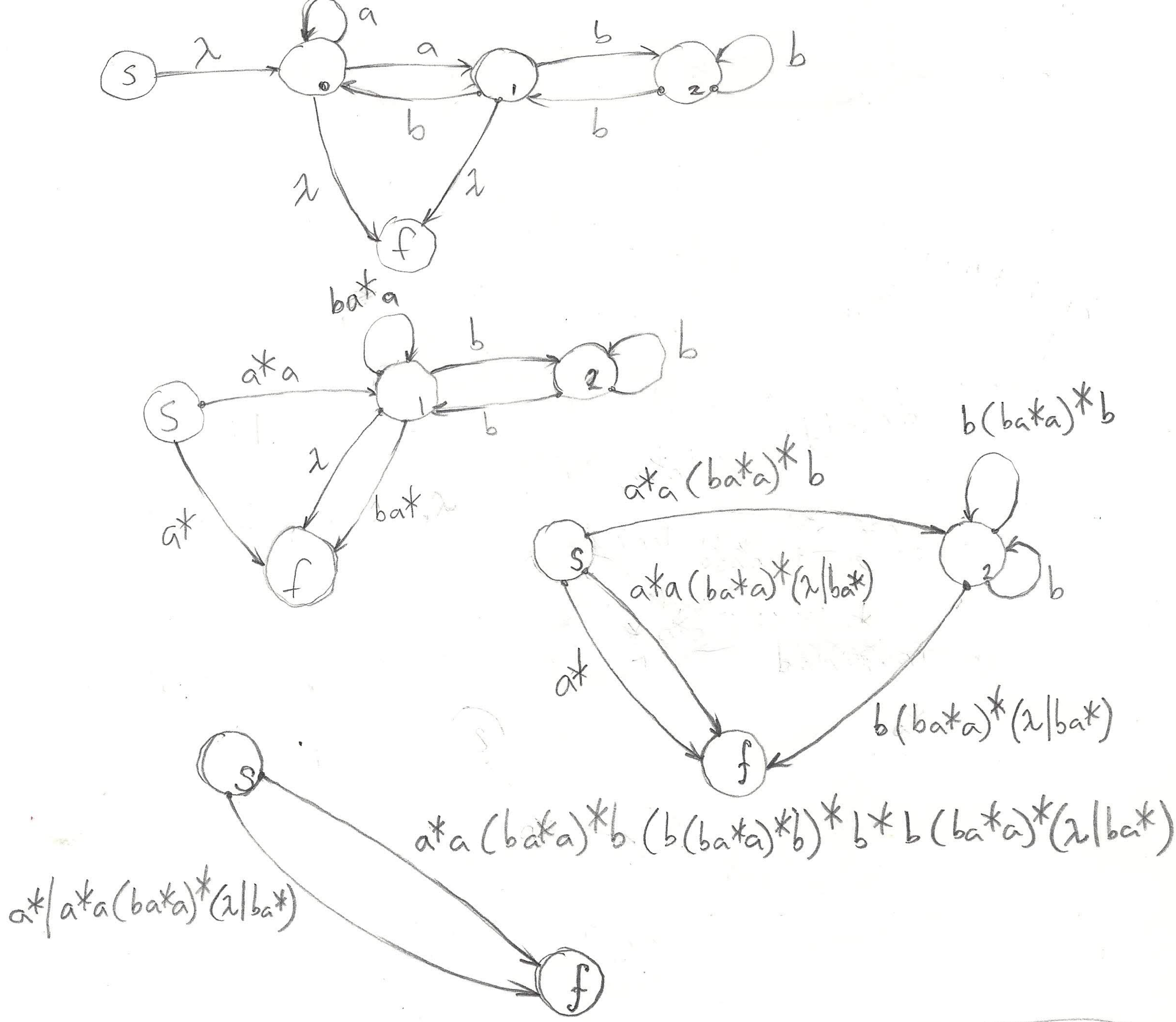


d.)

$a^*a(ba^*a)^*(bb^*b)^*(\lambda | bb^*)$

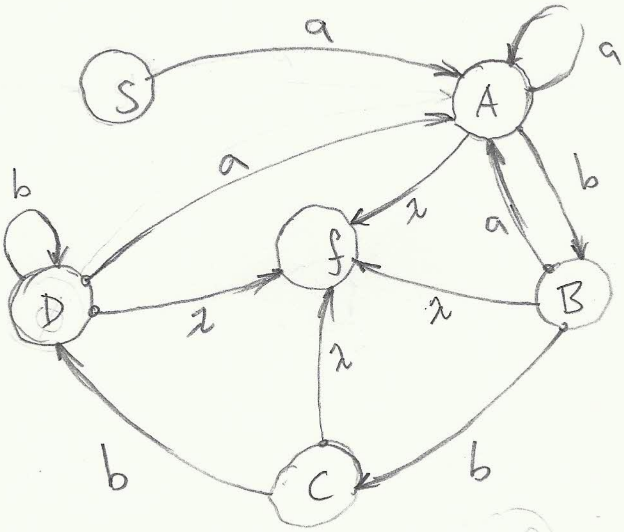


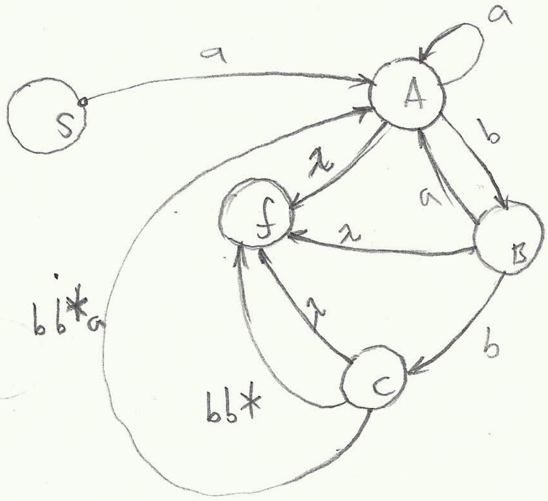
Note:
This should be the same as the RE derived from the equivalent DFA (although mistakes are probable), and f.) should be the same with just λ being added in to d.) (Looking at the DFA, changing $\{q_0, q_1\}$ to be the accepting states just adds the start state to the F states and all the other Fstates remain.

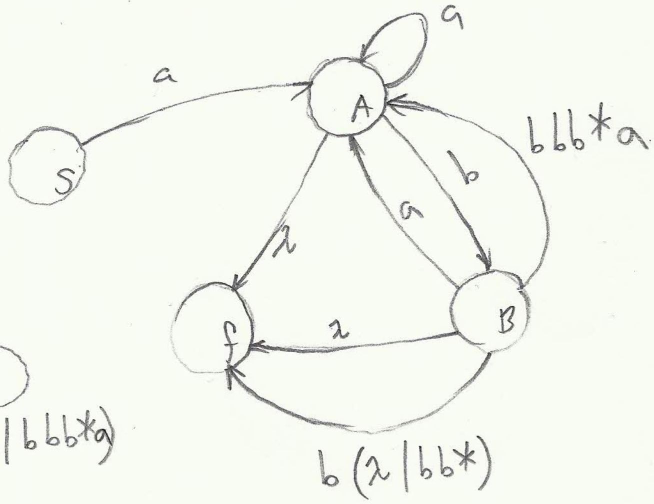


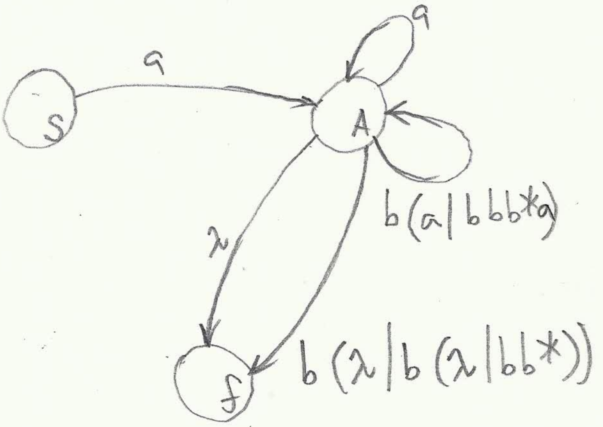
f.

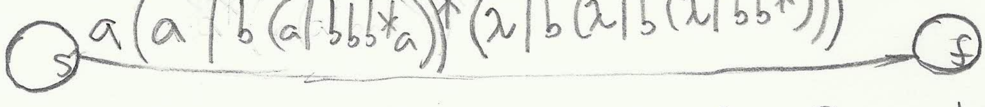
$a^* \mid a^*a(ba^*a)^*(\lambda \mid ba^*) \mid a^*a(ba^*a)^*b(b(ba^*a)^*b)^*b^*b(ba^*a)^*(\lambda \mid ba^*)$











is this equal to d. ? should be, but probable mistakes...