Due: Tuesday, Sept 17, 11:59PM
60 points

On homework, you may discuss with other students in the course about how to solve a problem, but the write-up should be your own. You **must include the names** of any students you consulted with. Give credit where credit is due. You can use JFLAP (use Version 7) to check your answer on many of these problems.

All JFLAP files mentioned below are on www.jflap.org.

SUBMISSION:

1. Submit all written parts on Gradescope under homework 3. For the written parts, you should submit one .pdf file.

2. For the parts that specify to create a JFLAP file, you should submit all the JFLAP files in one .zip file under homework 3 in Canvas.

Name your .zip file YOURNETID-hw3-jflap.zip For example, if your netid was abc12, your file name would be abc12-hw3-jflap.zip

PART 1:

1. (5 pts) Define exchange($a_1a_2 \ldots a_{n-1}a_n$) = $a_na_2 \ldots a_{n-1}a_1$ (swap first and last character) and exchange(L) = $\{v \mid v =$exchange(w) for some $w \in$L$\}$. Show that the family of regular languages is closed under exchange. (this just means to show that if L is regular, then exchange(L) is regular.)

2. (5 pts) Consider the following property, ReplaceFirstaaWitha (RFaaWa). If L is a regular language, then

$$\text{RFaaWa}(L)=\{w = uav \mid uaav \in L, u \in \Sigma^*, u \text{ does not have the substring } aa, u \text{ does not end in } a, \text{ and } v \in \Sigma^*\} \cup \{w \in L \mid w \text{ does not have the substring } aa \}.$$

with $\Sigma = \{a, b\}$. In other words, RFaaWa(L) accepts a word from L with the first aa replaced by a. For example, if $aababaa \in$L, then $ababaa \in$RFaaWa(L). If $babab \in$L, then $babab \in$RFaaWa(L). If $aaaab \in$L, then $aaab \in$RFaaWa(L).
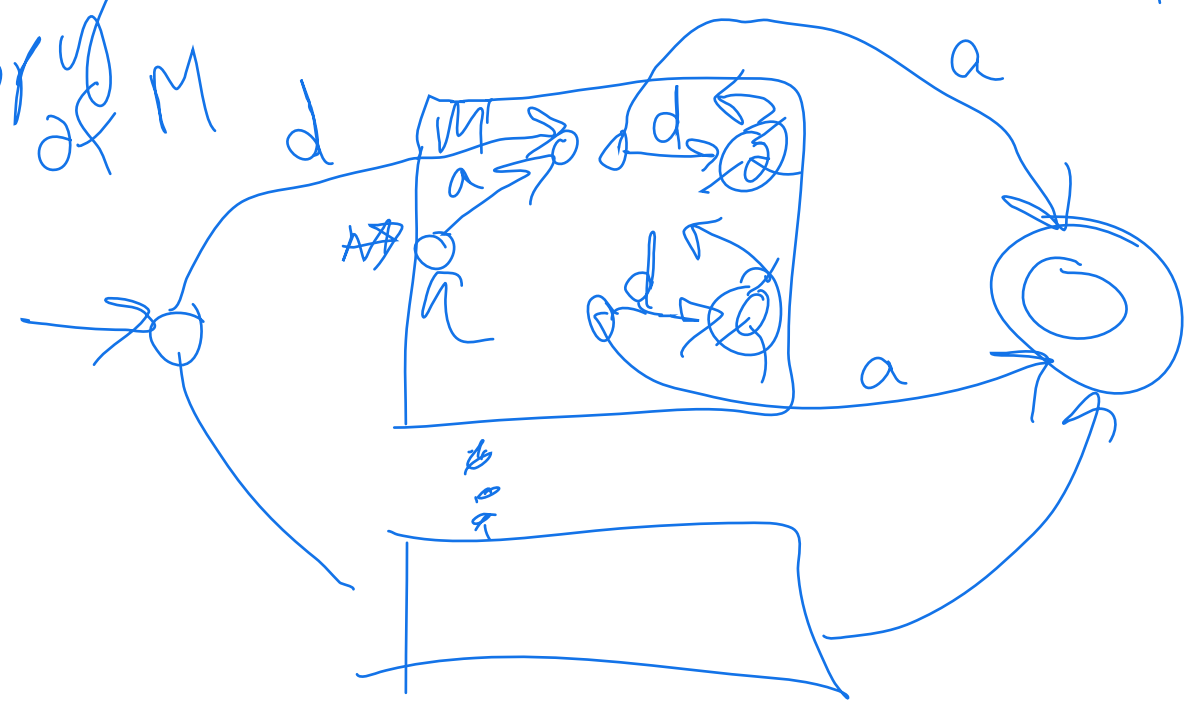
Show that the regular languages are closed under the RFaaWa(L) property.

$\exists$ DFA M for L $\Sigma = \{a, b, c, d\}$

$abcbd \longrightarrow dbcba$

in L in exchange(L)

copy of M
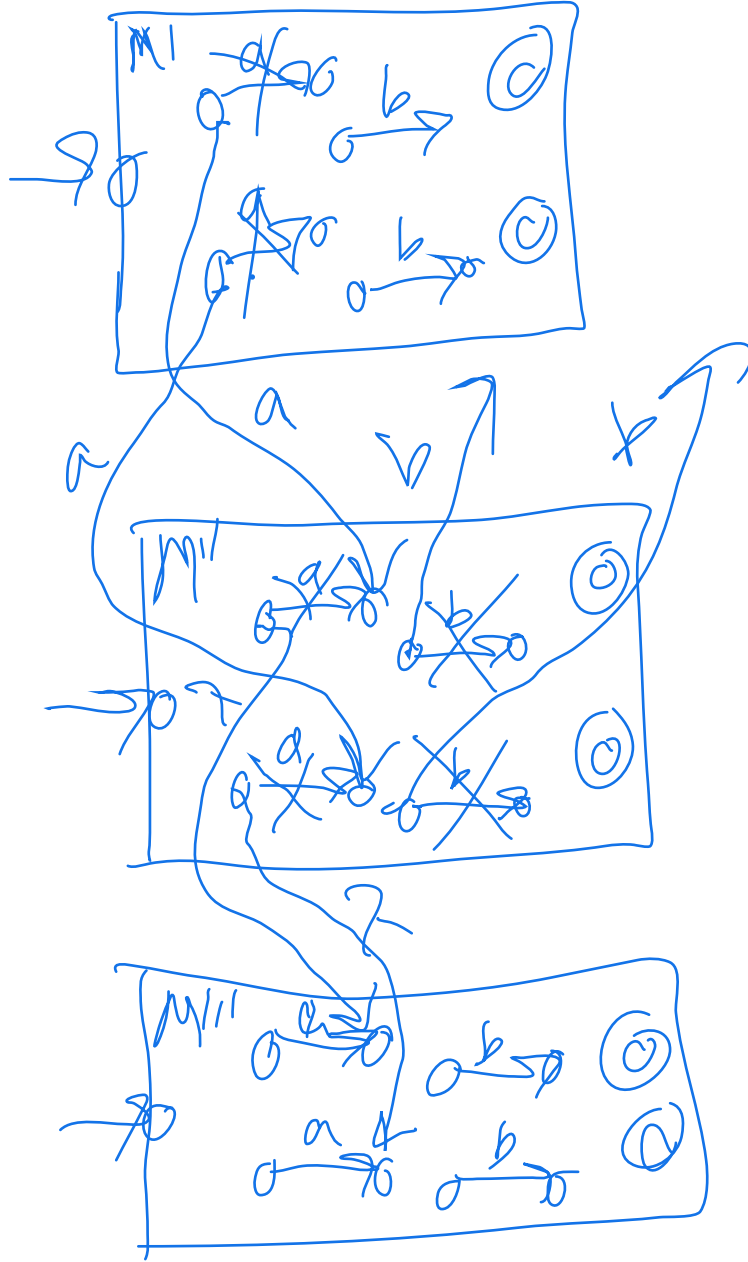

new
& only
final
state

hint #2   replace First aa w/ a

L regular → ∃ DFA M

$\{\Sigma = \{a, b\}\}$

3. (5 pts) Convert the following DFA into a DFA with the fewest number of states using the algorithm discussed in class. Show the tree distinguishing the states and explain at each level the reason for distinguishing the states. Show the resulting minimal DFA (by showing the transition diagram). You can use JFLAP to check your answer but this must be turned in on paper. Use the file ex2-dfa2mindfa-c (also shown below).
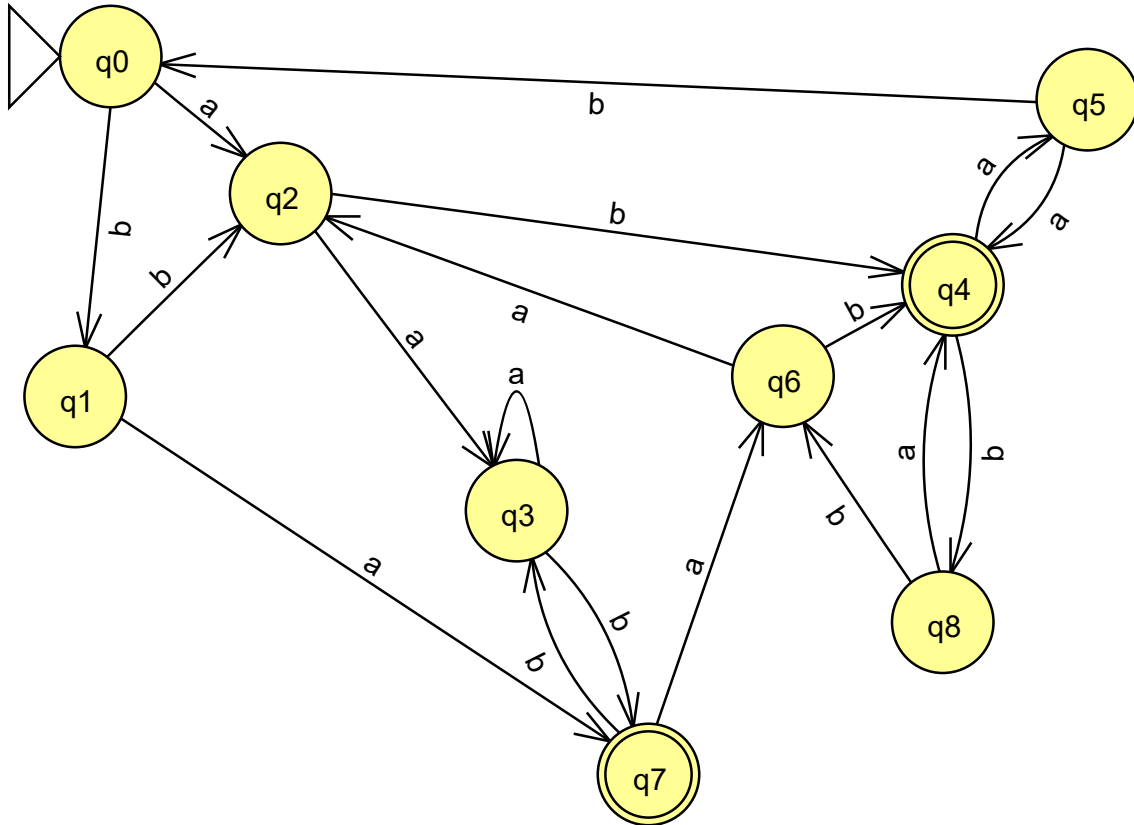
4. (5 pts) Same problem as the previous one, this time use the file ex2-dfa2mindfa-e (also shown below).
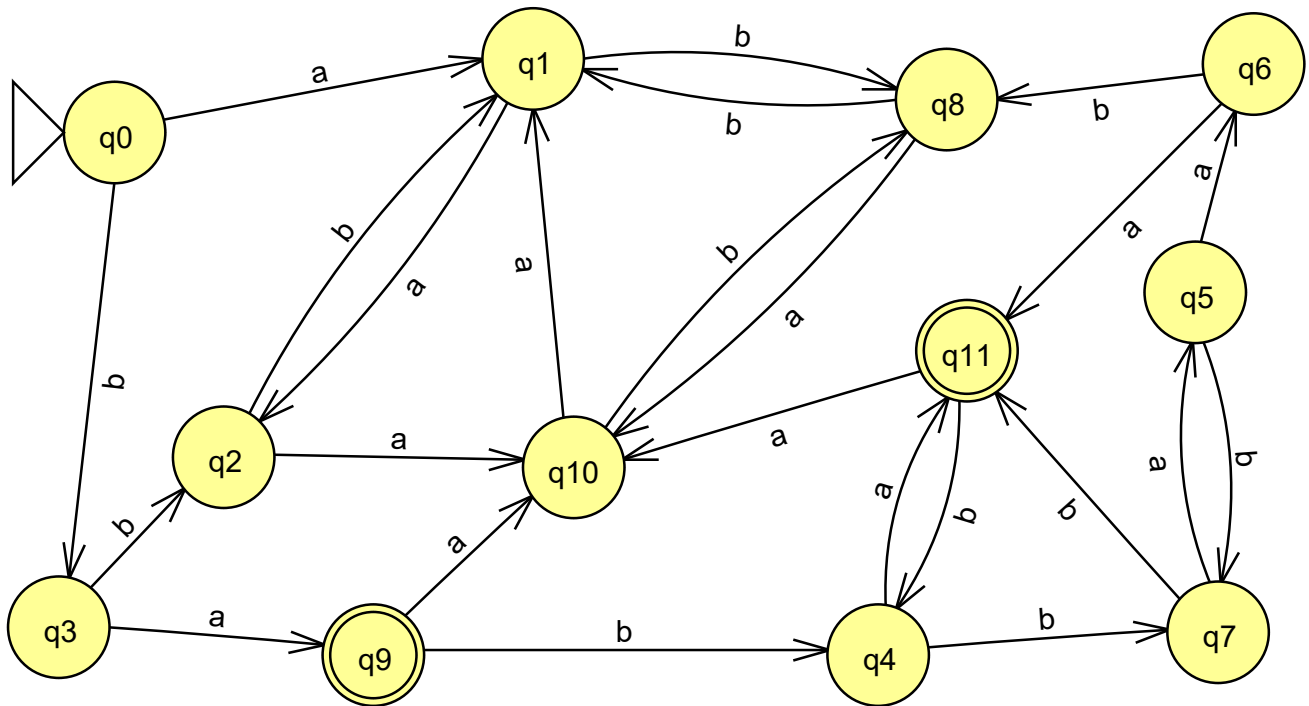
5. (4 pts) Problem 6 in Chapter 2 JFLAP book. Write the five strings accepted and the one that is not.
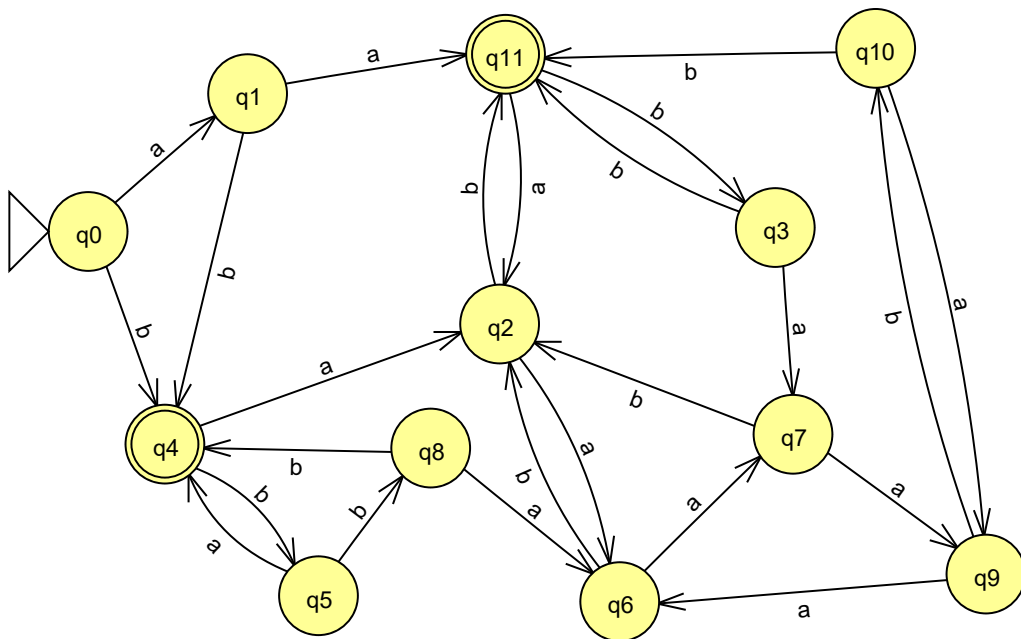
6. (4 pts)Problem 1(b) in Chapter 3 JFLAP book.

LHS		RHS
S	→	bA
A	→	abaA
A	→	abaB
B	→	b
B	→	λ

7. (4 pts)Problem 1(e) in Chapter 3 JFLAP book.

LHS		RHS
S	→	aS
S	→	bB
S	→	λ
B	→	bB
B	→	bS

8. (4 pts)Problem 5(b) in Chapter 3 JFLAP book. Write out the FA.

LHS		RHS
S	→	aS
S	→	aA
A	→	bB
A	→	cC
B	→	bS
B	→	b
C	→	cS
C	→	λ

9. (4 pts)Problem 6(c) in Chapter 3 JFLAP book. Write out the regular grammar.
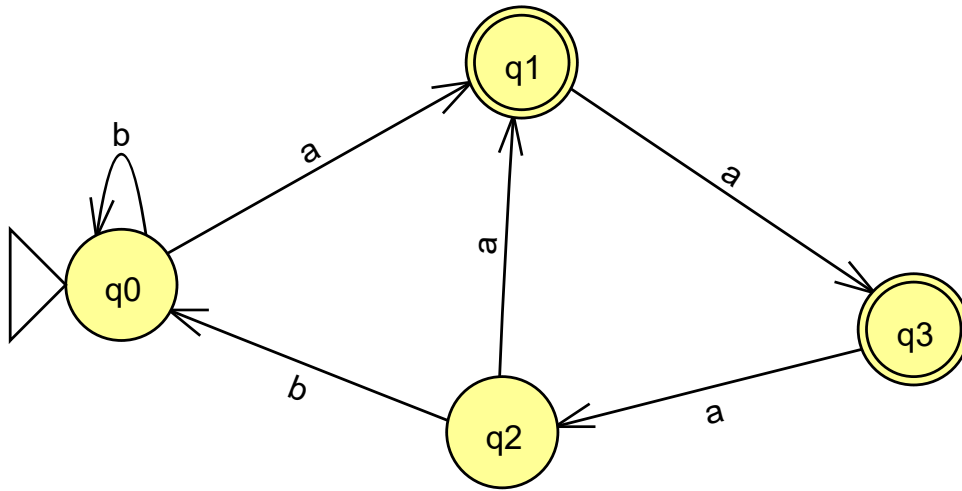
10. (4 pts)Problem 1(f) in Chapter 4 JFLAP book. List the strings.

11. (4 pts)Problem 4(f) in Chapter 4 JFLAP book. List the regular expression.
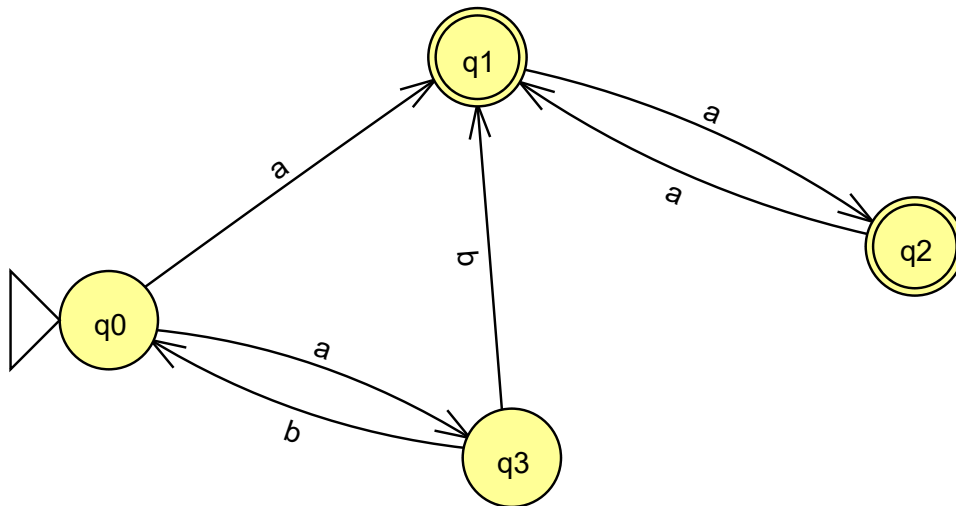
PART 2:

1. (4 pts) Problem 2(d) in JFLAP book Chapter 3. Name this JFLAP file: ch3prob2d

2. (4 pts) Problem 2(e) in JFLAP book Chapter 3. Name this JFLAP file: ch3prob2e

3. (4 pts) Problem 2(d) in JFLAP book Chapter 4. Name this JFLAP file: ch4prob2d