<div align="center">

PART 1 Due: Thursday, Feb. 2, beginning of class
PART 2 Due: Thursday, Feb 2, 11:59PM
60 points

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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 to check your answer on many of these problems.

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

PART 1: Written, Bring to class

1. (5 pts) Define exchange($a_1 a_2 \ldots a_{n-1} a_n$) = $a_n a_2 \ldots a_{n-1} a_1$ (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.

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

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

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.

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).
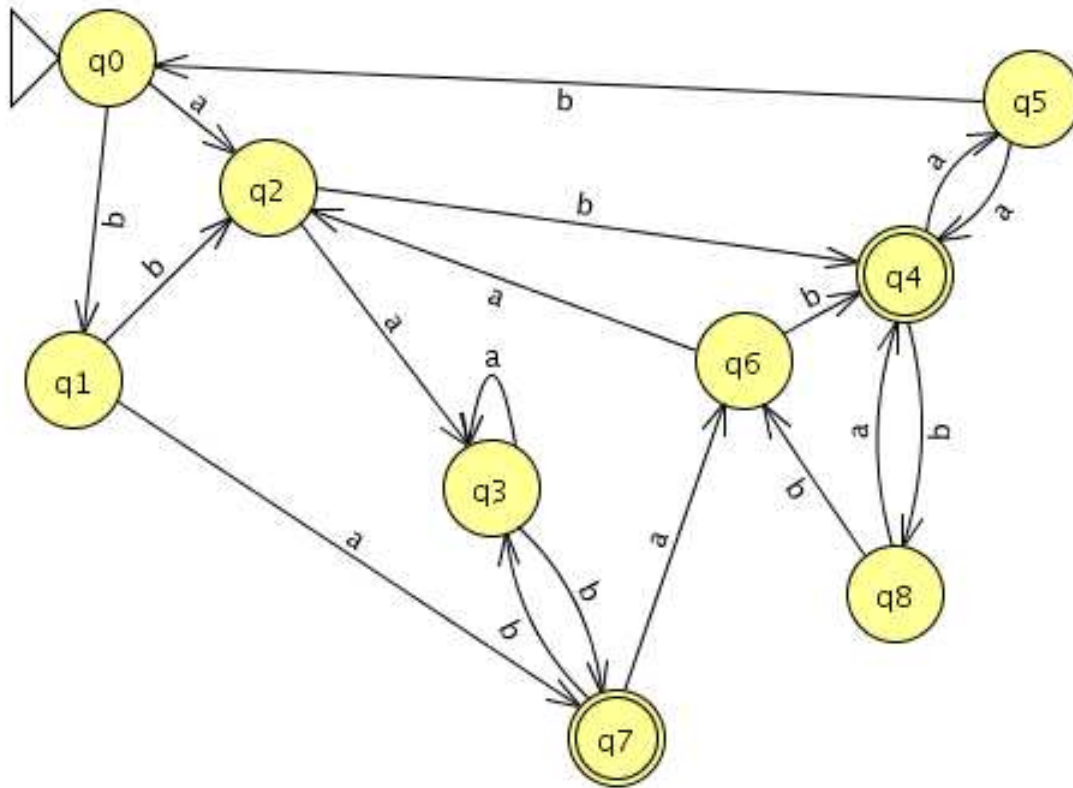
4. (5 pts) Same problem as the previous one, this time use the file ex2-dfa2mindfa-e (also shown below).
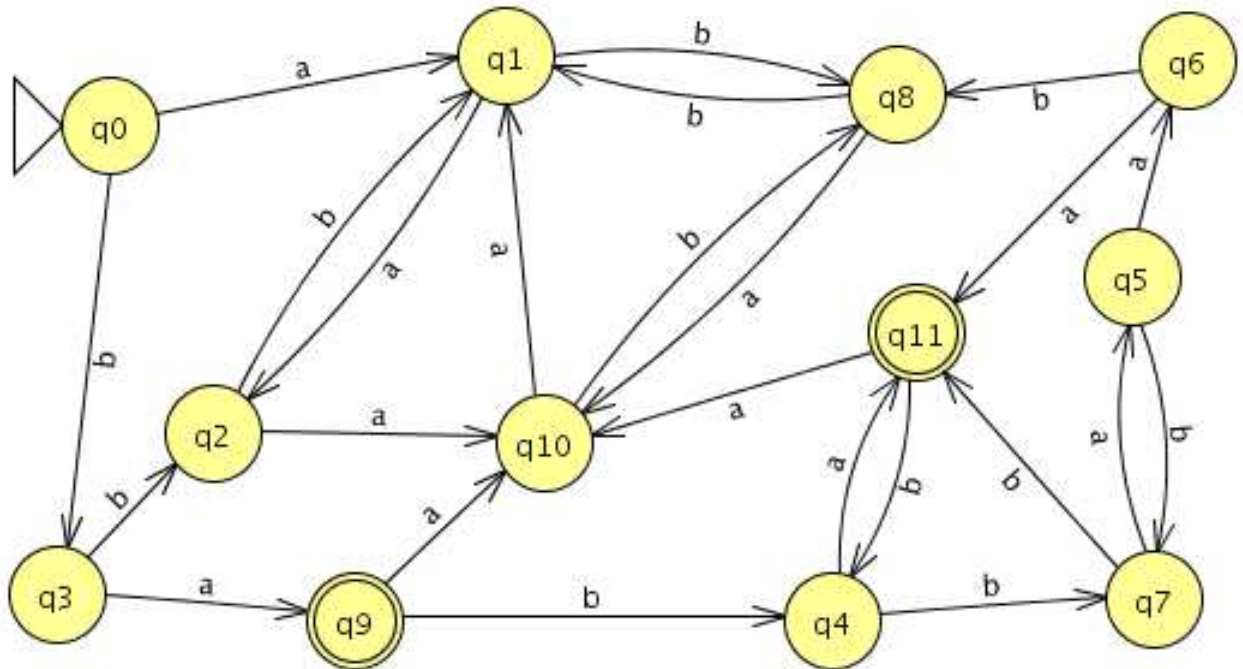
5. (4 pts) Problem 6 in Chapter 2 JFLAP book. Write the five strings accepted and the one that is not.
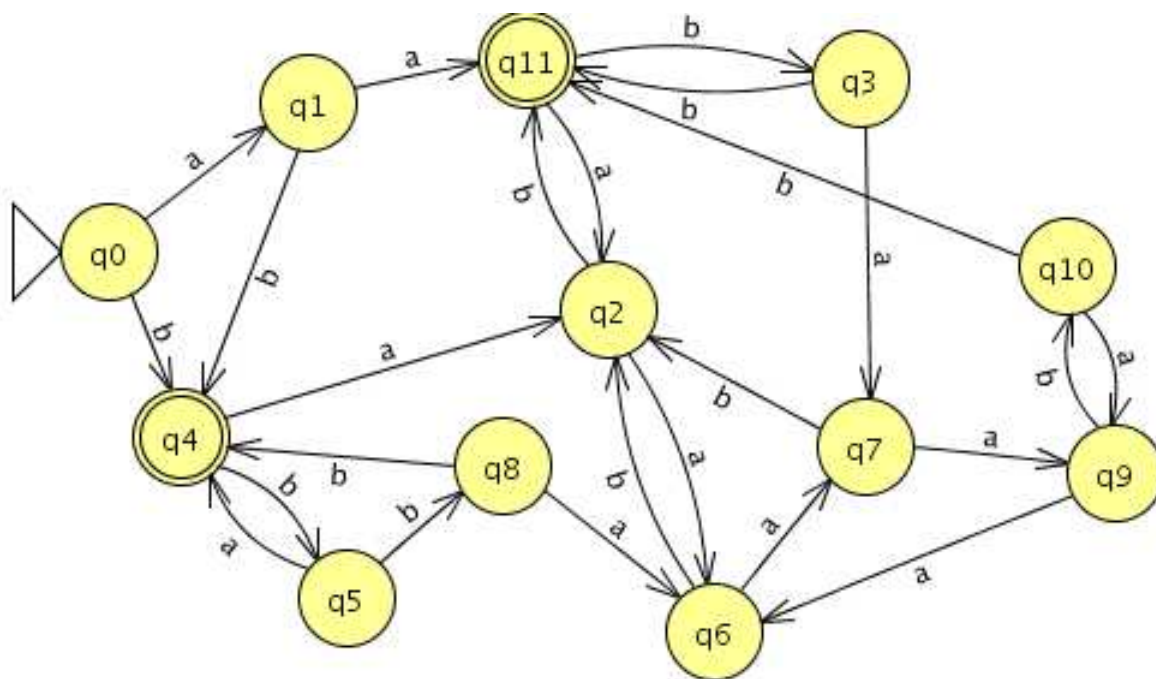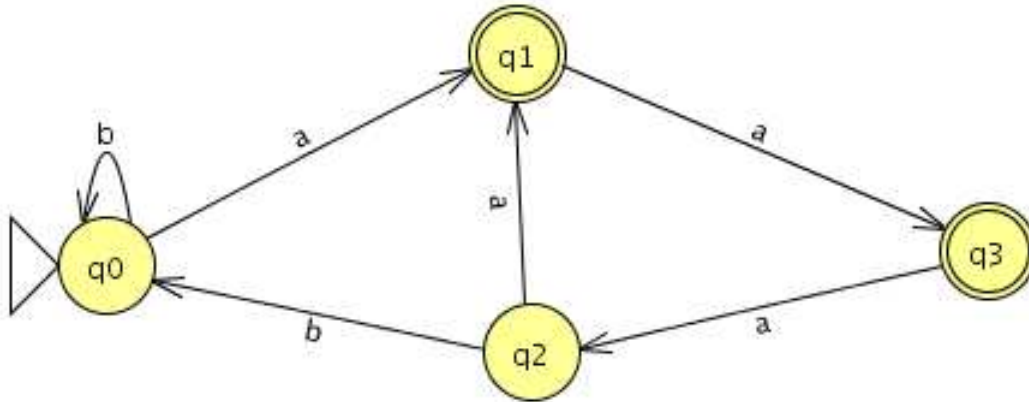
6. (4 pts)Problem 1(b) in Chapter 3 JFLAP book.

S	$\longrightarrow$ bA
A	$\longrightarrow$ abaA
A	$\longrightarrow$ abaB
B	$\longrightarrow$ b
B	$\longrightarrow \lambda$

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

S	$\longrightarrow$ aS
S	$\longrightarrow$ bB
S	$\longrightarrow \lambda$
B	$\longrightarrow$ bB
B	$\longrightarrow$ bS

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

S	$\longrightarrow$ aS
S	$\longrightarrow$ aA
A	$\longrightarrow$ bB
A	$\longrightarrow$ cC
B	$\longrightarrow$ bS
B	$\longrightarrow$ b
C	$\longrightarrow$ cS
C	$\longrightarrow \lambda$

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.
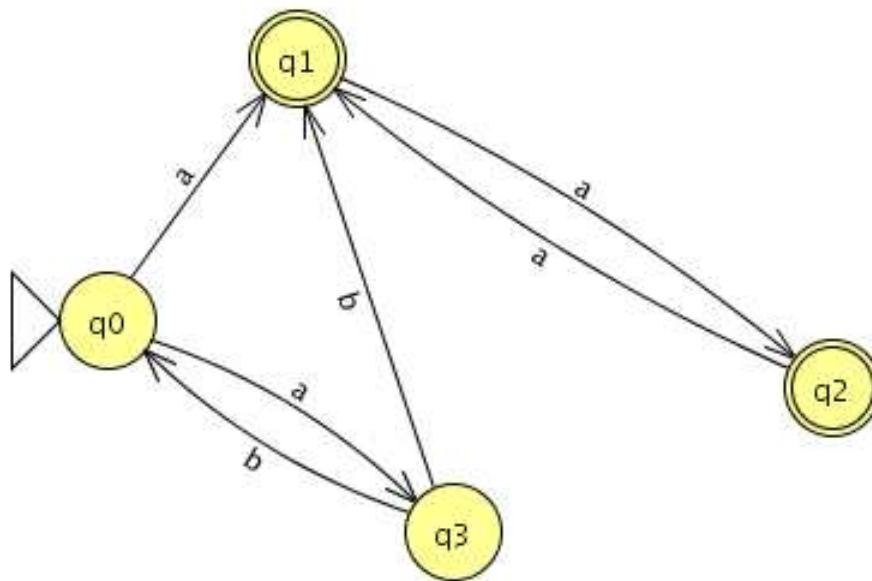
PART 2: Submit online

Submit these files online.

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

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

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

Submitting Part 2

To submit files, use Eclipse. Make sure you select *cps140* and *homework3* for the location to submit.

Submit a README file and all the .jff files at one time. In this case the README file should have your name in it and any other information such as who you got help from.

You can submit more than once, if so, we only grade the last submission.

JFLAP

JFLAP is available www.jflap.org.