On my honor, I have not given, nor received, nor witnessed any unauthorized assistance on this work.

Print name and sign: _____

Question:	1	2	3	Total
Points:	4	13	13	30
Score:				

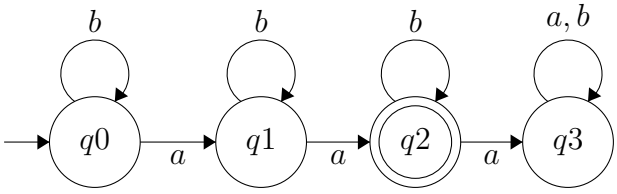
1. (4 points) Professor Summet is giving a mini-lecture on regular expressions. She says, "Kleene star also distributes over the or operation! For example, if you have $(a|b)^*$ that's the same as $(a^*|b^*)$." Later, you tell your teammates that Dr. Summet is obviously having a bad day and is incorrect. Explain how you know she is incorrect. You can give concrete examples if it helps your explanation.

Solution: $(a|b)^*$ means that either 'a' or 'b' is repeated. It's the same thing as $(a|b)(a|b)(a|b)$.... This could lead to strings like aba, aaa, bbb, bba and so on.

On the other hand, $a^*|b^*$ means 'a' repeated 0 or more times **OR** 'b' repeated 0 or more times. It's the same as $(a)(a)(a)(a)$... **OR** $(b)(b)(b)$... and leads to strings like a, aa, aaa, b, bb, bbb but not strings which combine a and b.

Common mistake: Several people said that $(a^*|b^*)$ represented something like "0 or more a's followed by 0 or more b's". This answer confused union ("or") with concatenation and answered as if the question had asked about (a^*b^*).

2. Consider the following DFA:



(a) (2 points) Give two strings (including the shortest string) that this DFA accepts.

Solution: The shortest is aa. Many answers possible for the second string, but some are baba, aabbb...

(b) (5 points) Give the formal 5-tuple definition for this DFA.

Solution: $M = \{\{q0, q1, q2, q3\}, \{a, b\}, \delta, q0, \{q2\}\}$

where the transition function δ is described by this transition table.

	a	b
q0	q1	q0
q1	q2	q1
q2	q3	q2
q3	q3	q3

(c) (2 points) Informally describe the language this DFA recognizes.

Solution: Strings that contain exactly 2 a's.

(d) (4 points) Give a regular expression for the language this DFA accepts.

Solution: $b^*ab^*ab^*$

3. Given the alphabet $\Sigma = \{0, 1\}$ and the language L represented by the regular expression:
$(0(0|1)^*0)|(1(0|1)^*1)$

(a) (4 points) Informally describe the language L.

Solution: Set of all strings which begin and end with the same symbol (and is at least 2 characters long).

(b) (4 points) For each of the following strings s, state whether $s \in L$ or not.

i. ϵ no

ii. 1 no

iii. 0000 yes

iv. 1010101 yes

(c) (5 points) Draw a DFA for this language.

Solution: