Name:______________________________

You are permitted to work in groups, get help from others, read books, and use the internet. You will receive a message from the graduate assistant, Zachary Edwards, telling you how to turn in the assignment.

1. Identify which machine accepts the language defined by each regular expression.

(a) $a^* + b^*$
(b) $\lambda$
(c) $a^*$
(d) $\emptyset$
(e) $a(aa + b)^*$
(f) $a^*b^*$
(g) $(a + b)^*$
(h) $(ab)^*$

![Diagrams of machines M1 to M8]

2. True or False.

(a) _______ If $L$ is any language, $L + L = L$
(b) _______ If $L$ is any language, $L \cap L = L$
(c) _______ If $L$ is any language, $\{\lambda\} \in L^*$.
3. Let $L_1 = \{a, ab\}$ and $L_2 = \{a, ba\}$. How many strings are there in the language $L_1 L_2$? 
How many strings are there in the language $L_2 L_1$?

4. True or False. These are harder.

(a) _____ Any language consisting of all decimal numerals of an arithmetic sequence (for example: 
$\{5 + 8n : n \geq 0\} = \{5, 13, 21, 29, 37, 45, \ldots\}$) is regular.

(b) _____ Let $L$ be a regular binary language. Let $L'$ be the language of all strings obtained from 
members of $L$ by substituting $ab$ for 0 and $c$ for 1. Then $L'$ must be regular. For example, if $L = 
\{0, 10, 10011\}$ then $L' = \{ab, cab, cababcc\}$.

5. Any NFA with $n$ states is equivalent to some DFA with at most $2^n$ states, counting the dead state. Draw 
a DFA equivalent to the following three state NFA. For just this problem, include the dead state in your 
figure.

Show your work.