Name:_____ Grade:_____<-- instructor use

0. (0) Here are the Regular expressions:
   1. $L(\varnothing) = \varnothing$.
   2. 2. $L(\varepsilon) = \{\varepsilon\}$.
   3. 3. *If* $c \in \Sigma$, $L(c) = \{c\}$.
   4. 4. $L(\alpha\beta) = L(\alpha)\ L(\beta)$.
   5. 5. $L(\alpha \cup \beta) = L(\alpha) \cup L(\beta)$.
   6. 6. $L(\alpha^*) = (L(\alpha))^*$.
   7. 7. $L(\alpha^+) = L(\alpha\alpha^*) = L(\alpha)\ (L(\alpha))^*$. If $L(\alpha)$ is equal to $\varnothing$, then $L(\alpha^+)$ is also equal to $\varnothing$. Otherwise $L(\alpha^+)$ is the language that is formed by concatenating together one or more strings drawn from $L(\alpha)$.
   8. 8. $L((\alpha)) = L(\alpha)$.

1. State the Myhill-Nerode Theorem
   A language is regular iff the number of equivalence classes of $\approx_L$ is finite.

2. Which of the above rules are "syntactic sugar", i.e., very convenient but not strictly necessary? Why?

   2, because ε can be expressed as $\varnothing^*$

   7, because $\alpha^+ = \alpha\alpha^*$

3. Write a regular expression r such that L(r) = {$w \in$ {a, b}*: |w| is even}
   Here are two possibilities: $(a \cup b)\ (a \cup b))^*$ $(aa \cup ab \cup ba \cup bb)^*$

4. Write a regular expression for {$w \in$ {0, 1}*: w is a binary representation of a multiple of 4}.

   Here is one possibility: $0 \cup 1(0 \cup 1)^*00$

5. Write a regular expression r such that L(r) = {$w \in$ {a, b}*: w contains an odd number of a's}
   Here are two possibilities: b* (ab*ab*)* a b* b* a b* (ab*ab*)*

6. $L(\ (a \cup \varepsilon)^*\ ) =$ $\{a\}^*$

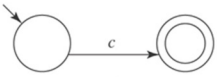
7. Write a regular expression for $L = \{w \in \{a, b\}^* :$ no two consecutive letters in w are the same$\}$
   $((ab)^*(a \cup \varepsilon)) \cup ((ba)^*b)$ Other answers are possible

8. State Kleene's Theorem
   A language is regular iff it is defined by some regular expression.

9. Tell your instructor about anything from today's session (or from the course so far) that you found confusing or still have a question about. If none, please write "None". Students must write something.

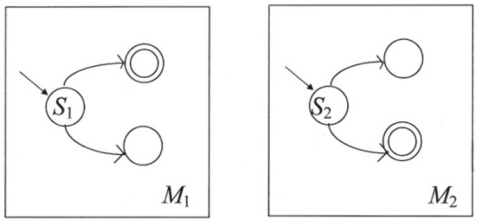
∅:

A single element of Σ:



ε (∅*):

Union:



Concatenation:

Kleene star: