CSI 350 — Theory of Computation, Fall 2005

Quiz #4 - Monday, September 26, 2005

Name & Honor Code: _____

Given the regular expression: $R = a^* \cup b^*$, answer the following questions.

1. Does R describe a regular language? Why or why not?

   Yes, because if a language is described by a regular expression, then it is regular.

2. Name two strings that are described by R and name two strings that are not described by R.

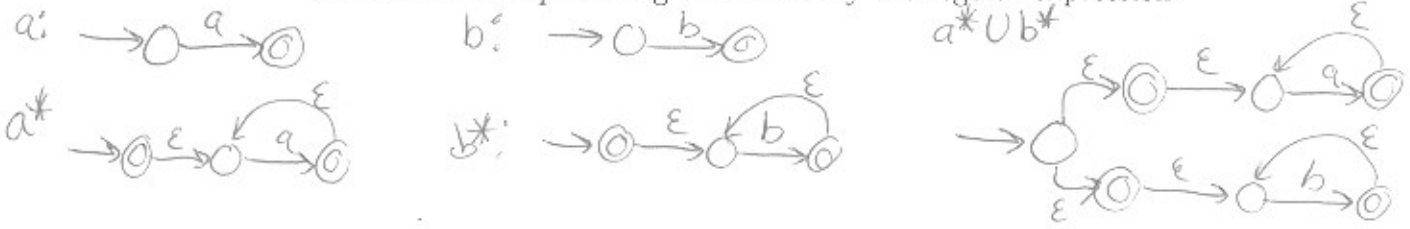
   $\varepsilon \in R$ $\quad ab \notin R$

   $a \in R$ $\quad ba \notin R$

   $aa \in R$ $\quad aaba \notin R$

   $bbb \in R$

3. Convert the regular expression into an NFA. In other words, create an NFA which accepts strings described by the regular expression.



4. The NFA you created, has some pumping length p. The pumping length demonstrates that strings of a length at least p must pass through the same state at least once. This path forms a loop due to the pigeonhole principle. Choose a string, s, described by the regular expression of a length at least p. Does this string obey the pumping lemma? Prove your answer.

   $S = a^p$

   $x = \varepsilon$ $\quad |xy| \leq p$

   $y = a^p$ $\quad |y| > 0$

   $z = \varepsilon$ $\quad xy^iz, \ \forall i \geq 0$

   $xz = \varepsilon, \quad \varepsilon \in R$

   $xyz = a^p, \quad a^p \in R$

   $xyyz = a^{p+p} \quad a^{p+p} \in R$

   $xy^iz = a^{ip} \quad a^{ip} \in R$