COMP3721 Tutorial 1

1 Sets

1. Determine whether each of the following is true or false.
   (a) $\emptyset \in \emptyset$
   (b) $\emptyset \subseteq \emptyset$
   (c) $\{a, b\} \subseteq \{a, b, \{a, b\}\}$
   (d) $\{a, b\} \in \{a, b, \{a, b\}\}$

2 Languages and Regular Expressions

1. Show that if a and b are distinct symbols, then $\{a, b\}^* = \{a\}^*(\{b\}\{a\}^*)^*$.
2. Which of the following are true? Explain.
   (a) $abcd \in (a(cd)^*b)^*$
   (b) $\{a^n b^n : n \geq 0\}\{b^n c^n : n \geq 0\} = \{a^n b^{2n} c^n : n \geq 0\}$
3. Let $\Sigma = \{a, b\}$. Write regular expressions for the following sets:
   (a) All strings in Σ^* with no more than three a's.
   (b) All strings in Σ^* with a number of a's divisible by three.
   (c) All strings in Σ^* that does not have aab as a substring.
4. Prove that if L is regular, then so is $L' = \{w : uw \in L \text{ for some string } u\}$.