Department of Computer Science **University of San Francisco**

Computer Science 411
Homework 2: Regular Expressions and DFA
Due Friday, September 11th 2015

1. For each of the following regular expressions, give a minimum-length string in $(a+b)^*$ *not* in the language.

   (a) (2 points) $b^*(ab)^*(ba)^*a^*$

   (b) (2 points) $(b^* + a^*)(a^* + b^*)(b^* + a^*)$

   (c) (2 points) $(a+b)^*a(a+b)^*b(a+b)^*$

   (d) (2 points) $b^*(a+ba)^*b^*$

2. Give a regular expression for each of the following languages:

   (a) (4 points) All strings over $\{a, b\}$ that end in bab

   (b) (4 points) All strings over $\{a, b\}$ that do *not* end in bab

   (c) (4 points) All strings over $\{a, b\}$ that contain the substring abb but not the substring aa.

   (d) (4 points) All strings over $\{0, 1\}$ that do not contain the substring 1111

   (e) (4 points) All strings over $\{0, 1\}$ that represent binary numbers x, such that (x mod 4) == 0. Leading zeroes are ok (so 0000100 would be in the language, for instance)

3. Give a Deterministic Finite Automaton for each of the following languages:

   (a) (4 points) The finite language $L = \{aaa, bbb, bab\}$

   (b) (4 points) All strings over $\{a, b\}$ that end in baa

   (c) (4 points) All strings over $\{a, b\}$ that do *not* end in baa

   (d) (4 points) All strings over $\{a, b\}$ that contain the substring bbab