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 okay (so 000100 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