CS5104 Assignment 2  
Due: Wednesday, February 25.

For problem 1 to 7, construct a regular expression for the language described in English.

1. All words in which a appears tripled, if at all. This means every clump of a’s contains 3 or 6 or 9 or 12 …. a’s.

2. All words that contain exactly two b’s or exactly three b’s, not more.

3. (i) All strings that end with a double letter.  
   (ii) All strings that do not end in a double letter.

4. All strings that have exactly one double letter in them.

5. All strings in which the letter b is never tripled. This means that no word contains the substring bbb

6. All words in which a is tripled or b is tripled, but not both. This means each word contains the substring aaa or the substring bbb but not both.

7. All strings in which the total number of a’s is divisible by 3 no matter how they are distributed, such as aabaabbaba.

8. Show that the following pairs of regular expressions define the same language over the alphabet {a b}  
   (i) (ab)*a and a(ba)*  
   (ii) (a+b)* and (a+b)*  
   (iii) (a+b)* and (a+b)*

9. Describe in English the languages associated with the following regular expressions.
   (i). (a(a+bb)*)*  
   (ii). (b(bb)*)*(a(aa)*b(bb)*)*  
   (iii). ((a+b)a)*

10. Find a DFA or NFA that accepts the language 10+(0+11)0*1