1. (80 points, 10+10 points each)

For each of the following languages:

(i) Construct a regular expression that describes the language, and
(ii) Build a DFA that accepts the described language. Explain how the machine works. 
No points will be given to machines without accompanying “comments”.

(a) The empty set (over \{a, b\}).
(b) The empty string (over \{a, b\}).
(c) The strings that contain substring ‘abba’ over \{a, b\}.
(d) The strings that begin with a, and do not contain ‘bc’ over \{a, b, c\}.

2. (20 points) Use the procedure described in class to construct the machine \(M_3\) that corresponds to the “product” of machines \(M_1\) and \(M_2\). In other words, \(L(M_3) = L(M_1) \cap L(M_2)\).

\(M_1\) accepts the strings that do not contain ‘aa’.
\(M_2\) accepts the strings that end with ‘ab’.

Test all three machines with the four strings \(aa, ab, aba, aab\) and state whether they are accepted.