1. Describe the following languages as regular expressions:
   (a) \( \{ w \in \{a, b\}^* \mid w \text{ contains the substring } aa \text{ or } bb \} \),
   (b) \( \{ w \in \{a, b\}^* \mid w \text{ does not contain the substring } aa \text{ nor } bb \} \),
   (c) \( \{ w \in \{a, b\}^* \mid w \text{ contains the substrings } ab \text{ and } ba \text{ (which can overlap) } \} \),

2. (a) Following the construction of Theorem 1.55, give the NFA corresponding to the expression \((a \cup b)^*a\).
   (b) Following the construction of Theorem 1.39, give the equivalent DFA.

3. (a) Give a DFA for examining whether the input binary string contains at least twice the substring 11; the substrings may overlap.
   (b) Describe language recognized by the DFA as a regular expression.

4. Following the construction of Theorem 1.60, give the regular expressions corresponding to the following automata:

5. Give the regular expressions describing the language of the following automaton:

6. Prove that the language \( \{ a^m b^n c^{m+n} \mid m, n \geq 0 \} \) is not a regular one.