1. (a) State Kleene’s Theorem.

(b) List the three Kleene operators.

2. Apply the subset construction to produce a DFA that accepts the same language as the following NFA.

3. For each language, give 3 strings that are pairwise distinguishable with respect to that language:

(a) The set of all binary strings whose first and last bit are the same
(b) The set of all binary strings that contain 101 as substring
(c) The set of all binary strings of odd length.

4. For the alphabet \{a, b\}, give a CFG for:

(a) the set of all strings that start and end with \texttt{abba}
(b) the set of all even-length palindromes that contain \texttt{abba} as a substring.

5. Consider the following CFG with start variable \( S \):

\[
S \rightarrow 0T0 \mid 1T1 \mid 0T1 \mid 1T0 \mid \varepsilon \\
T \rightarrow 0S \mid 1S \mid \varepsilon
\]

(a) Give a derivation tree for the string 01010
(b) Describe in English the language of this grammar.