Homework 02

Lexical Analysis

1. Let set of symbols \( S = \{0, 1\} \).
   a. Draw a flow chart describing a DFA which accepts any string which can be produced from \( S \).
   b. Write a grammar for this language.
   c. Modify your flow chart so it can accept only strings of alternating 0 and 1, of any length.

2. Let \( R = \{\{2-9\}, A, T, J, Q, K\} \). Let \( S = \{H, C, D, S\} \).
   Let \( D \) be a sequence of arbitrary length of pairs of characters \( \{R,S\} \).
   a. Write a regular expression for this language.
   b. Convert the regular expression into a DFA.

3. Consider a programming language with which you are familiar.
   a. List some of the token types for this language.
   b. Write a \textit{Hello, world!} program in this language using key-value pairs based on the token types you have determined.

4. A certain language has a valid set of symbols \( T = \{=, $, \%, ,, \{0-9\}, \{A-Z\}\} \).
   In this language, identifiers may consist of any pattern matching the following:

   \[
   (\text{letter}) (\text{letter} | \text{digit})^+ (\varepsilon | \% | \$) 
   \]

   where \$ indicates a \textit{string}, \% indicates an \textit{integer}, and an identifier without either may be either an \textit{integer} or a \textit{floating-point} number. Strings must be enclosed in matching pairs of \" symbols.
   a. Write a flow chart describing a DFA which will accept statements of the form

   \[
   \text{identifier} = \text{value}
   \]
   b. Write pseudocode to implement a lexical analyser which will output tokens of appropriate types.