Exercises

1. Write a formal description (using the formulation) of the finite automaton that recognizes binary strings that represent even numbers.
2. Can you design a finite automaton that checks if a binary string has an equal number of ones and zeros?
3. Can you design a finite automaton that checks if a binary string has an equal number of ones and zeros such that no ‘0’ follows a ‘1’ character? That is, strings of the form ‘01’, ‘0011’, ‘000111’, but not ‘0101’, ‘001’, ‘0110’, etc.
4. What is the language recognized by this machine?

A diagram of a number and circles

Description automatically generated

1. Give an example of two strings that are accepted by and two strings that are not accepted by the following regular expressions:
2. Write the regular expression that recognizes each of the following languages. For each regular expression, implement it using Python’s RegEx syntax. Try to find the minimal DFA that recognizes each language.

Note - denotes the string concatenated with itself times. So denotes .

1. In certain programming languages, comments appear between delimiters such as ‘/#’ and ‘#/’. Let be the language of all valid delimited comment strings. A member of must begin with ‘/#’ and end with ‘#/’ but have no intervening ‘#/’. For simplicity, we'll say that the comments themselves are written with only the symbols and . hence the alphabet of is .
   1. Give a DFA that recognizes C.
   2. Give a regular expression that generates C.
2. Show that, if is a finite automata that recognizes language , swapping the accept and non-accept states in yields a new automata that recognizes the complement of . Conclude that the class of regular languages is closed under complement.
3. Write functions/programs (using re) in Python to accept an input string and strip all vowels.
4. Using Python’s re module, write a program to check if an input string is a valid phone number. A valid phone has a two- or three-digit country code (which may or may not be surrounded by parentheses), followed by a six-digit number. The country code and the number are separated by a hyphen. So (91)-551232 and 881-456987 are both valid phone numbers.