Problem 1 – DFA

Give a DFA for the following languages over the alphabet \{0, 1\}:

1. The set of all strings with an odd number of 0’s and an even number of 1’s.

2. The set of all strings beginning with a 1 which, interpreted as the binary representation of an integer, is congruent to zero modulo 5, i.e., \(<\text{bitstring}>\mod 5 = 0.\)

Problem 2 – NFA and DFA

Assume an alphabet with two symbols, s and r.

1. Draw the state transition graph of a DFA that accepts all strings over the alphabet that represents valid sequences of points in a single tennis game. A transition on input ”s” means that the server won the point, and a transition on ”r” means that the receiver won the point. Possible scores are 0/0, 0/15, 15/0, 15/15, 15/30, 30/15, 30/30, 30/40, 40/30, 0/30, 0/40, 30/0, 40/0, 15/40, 40/15, deuce, advantage s, advantage r, game.

   For example, your DFA should accept ”s s s s” and ”s r s r s r s r s r r r”.

2. Build the minimal DFA, or show that your DFA in part 1 is already minimal.

Problem 3 – NFA and DFA

1. Construct a nondeterministic finite automaton (NFA) for the regular expression \(c(ab)^*d\) using Thompson’s Construction Algorithm.

2. Convert your NFA with \(\epsilon\) transitions into a DFA using the subset construction.

3. Is the DFA minimal? If not, give the minimal DFA.