Automata
Create finite state automaton

Accept strings that consist of symbols 0 and 1, where the amount of 0’s is divisible by 2, and the amount of 1’s is divisible by 3

- Valid: 0011001
- Invalid: 011100
Create finite state automaton

• In automatons, you can keep track of how many symbols you have seen by creating states

• in this case, we need to make sure that we have an even number of 0’s and always three 1’s in order to be in an accepting state

• If we see three 0’s, we actually only need to remember the third one, since the combination of “00” is already valid
Create finite state automaton

- Which states are relevant?
  - Accepted states: (start state), 00, 111
  - Other: 0, 1, 11, 01, 011
NFA to DFA
NFA to DFA

• What are the differences between an NFA and a DFA?

• Conversion:

1. Create a table that shows the transitions of the NFA

2. Create a table that shows the transitions of the DFA

3. Create the DFA from the table
NFA to DFA
Regular Expressions
Describe the languages

\[ a(a|b)^*a \]
Describe the languages

$(((\varepsilon|a)b^*)^*)$
Describe the languages

\[(a|b)^*a(a|b)(a|b)\]
Describe the languages

a*ba*ba*ba*
Describe the languages

\[(aa|bb)^*\]

\[ ( (ab|ba) \]

\[(aa|bb)^* \]

\[(ab|ba) \]

\[(aa|bb)^* )^* \]
Regexp for Simplified C Function Prototype

- **Valid:**
  - int add(int a, int b);
  - char* cat3(char* a, char * b, char *c);
  - void dostuff();

- **Invalid:**
  - int foo;       // missing parentheses
  - int foo(int bar,)  // comma misplaced
  - int foo(int bar)  // no semicolon
Theory
Theory Question

Why can the resulting DFA have \textit{exponentially as many states} as the original NFA (after converting DFA->NFA)?
Lexical Analysis
Construct DFA that accepts $L$

$L = \{x, \text{xxx}, (\text{xxxx})+y\}$

// Note small error on lesson sheet
(* instead of +)
Construct DFA that accepts L

• Which states are relevant?
  • Accepted states: x, xxx, (xxxx)+y
  • Other: xx, xxxx, (xxxx)+x, (xxxx)+xx, (xxxx)+xxx
Tokenizing the input

- xx
- xxxxxxxxy (8 x’s)
- xxxxxxxxxxxxxxxxxxxxi (13 x’s)
Other Tips

• if you use LaTeX, check out the tikz library for plotting automaton