

ASSIGNMENT 8 (DUE ON 3 OCTOBER 2025)

MATH2301, SEMESTER 2, 2025

1. GENERAL REMARKS

- (1) The assignment is due on gradescope.
- (2) Please read the academic integrity policy for assignments. Remember that if you want an extension, you must ask at least 24 hours ahead of the deadline.
- (3) The words “show” and “prove” are synonyms. You may not be used to writing formal mathematical proofs, which is OK. Write a justification in plain language that would convince the reader.
- (4) If you are having trouble with any of the points, come and discuss with me in office hours. It is part of my job to help you understand this stuff, so please use my time!

2. PROBLEMS

2.1. **Problem.** Construct an NFA recognising the following languages. Justifications not required.

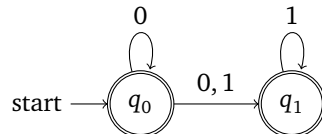
- (1)  $L = \{w \mid w \text{ ends with } 00\}$ .
- (2) The language  $L = L(1^*0^*1^*)$ .

2.2. **Problem.** Convert the following regular expressions to equivalent NFAs. (In each case, break down the given regex into manageable pieces such that you can directly construct a DFA/NFA for each “piece”. Then combine the pieces using the procedures we discussed in class.)

- (1)  $r = (0|1)^*000(0|1)^*$
- (2)  $r = (((00)^*(11))|01)^*$

2.3. **Problem.**

- (1) Convert the following NFA into an equivalent DFA.



- (2) Let  $L$  be the language of the DFA above. How many equivalence classes does  $\sim_L$  have? Justify your answer.

2.4. **Problem.** Let  $L$  be the language

$$L = \{w \mid \text{Read in binary, the number } w \text{ is divisible by } 3\}.$$

Is  $L$  recognised by an automaton? If yes, draw an DFA/NFA for  $L$ . Otherwise, justify why an automaton does not exist.

We make the convention that leading 0s do not affect the number. So the number 00011 is the same as the number 11, which is the number three.