

# CSC236 2015 Winter, Assignment 3

## due 6PM on Thursday April 2nd

You may work in groups of up to three people currently enrolled in CSC236. Submit your solutions to **MarkUs**. As described below, you should be submitting 5 files, named:

- `a3q1.png`
- `a3q1.txt`
- `a3q1b.pdf`
- `a3q2.png`
- `a3q2.txt`

Late assignments have a deduction of 5% per hour, for up to 20 hours.

You will receive 20% of the marks for any question (or part of a question) that you either leave blank or for which you write “I cannot answer this.”

Q1 (a) Construct a small DFA that accepts the set of decimal representations of natural numbers that are multiples of 3. So the alphabet is  $\{0, 1, \dots, 9\}$ . The DFA reads the decimal number from left to right. You should treat the empty string as the number 0 (which is a multiple of 3). Also, your DFA should accept strings such as 000003 and 0027 that contain leading 0s.

- You must submit a drawing of your DFA, and we strongly recommend using the following web app: <http://madebyevan.com/fsm/><sup>1</sup>. Use the PNG export option (between drawing canvas and instructions) and submit the resulting file to MarkUs, after renaming it to `a3q1.png`.
- You must also submit a specification of your DFA in a particular format, in a file named `a3q1.txt`. Assign a name to each state, with the start state named `s0`, and the other states named `s1`, `s2`,... etc. The first line of the text file should have the form

`accept si`

where `si` is the name of one of your states. If you have more than one accept state, write them all on that first line, separated by spaces, e.g. `accept s0 s2`.

The remaining lines each specify a single transition, and have the form

`si d sj`

where  $d \in \{0, \dots, 9\}$ , and `si` and `sj` are names of states. See end of this assignment for an example.

**Note:** If you made a  $k$ -state DFA, then your `a3q1.txt` should have exactly  $10k + 1$  lines, since the size of the alphabet is 10.

(b) Prove that no smaller DFA can compute the same language. Submit the proof as a pdf in a file named `a3q1b.pdf`

Q2 Draw a DFA that accepts the set of binary strings that contain 1011 as a substring. Follow the same instructions as Q1.(a) for what to submit, except the files should be named `a3q2.png` and `a3q2.txt`.

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<sup>1</sup>Note that on a Mac with no delete key separate from the backspace key, use `fn + backspace` for delete.

Following is a representation in the format required for `a3q1.txt` and `a3q2.txt`, but for the DFA drawn on this week's tutorial handout.

```
accept s4
s0 0 s1
s0 1 s0
s1 0 s2
s1 1 s0
s2 0 s2
s2 1 s3
s3 0 s1
s3 1 s4
s4 0 s4
s4 1 s4
```