Lassonde Faculty of Engineering
EECS
EECS2001Z. Problem Set No3
Posted: Mar. 18, 2019

Due: Apr. 3, 2019, by 4:30pm; in the course assignment box.

It is worth remembering (quoted from the course outline):

The answers must be typed (but you may dow symbols by hand, if it is easier for you).

The homework must be each individual's own work. While consultations with the instructor, tutor, and among students, are part of the learning process and are encouraged, nevertheless, *at the end of all this consultation* each student will have to produce an individual report rather than a copy (full or partial) of somebody else's report.

The concept of "late assignments" does not exist in this course.

1. (**5 MARKS**) Design a FA over $\{0, 1\}$ that accepts exactly all the strings of **odd length**.

E.g., ε, 00, 0110, 0000 are all **rejectable** while 0, 000, 01101 are all **acceptable**.

Clearly justify why your automaton works as stated (**NOT** by example; give a "general argument" or a "proof" if you prefer (although a proof is **not** required in this problem)).

2. (**5 MARKS**) Design a regular expression α over $\{0, 1\}$ that defines the language over $\{0, 1\}$ of all the strings of **even length**.

E.g., ε, 00, 0110, 0000 are all in $L(\alpha)$ while 0, 000, 01101 are not.

Clearly justify why your regular expression works as stated (**NOT** by example; give a "general argument" or a "proof" if you prefer (although a proof is **not** required in this problem)).

3. (**5 MARKS**) Build an NFA that accepts precisely all the strings over $\{0, 1\}$ of length ≥ 3 that contain at least one 1 among their last 3 symbols.

You must argue that your design is correct. Again, **NOT** by example.

4. (**4 MARKS**) Consider the FA below.

	0	1
$\rightarrow q_1$	q_2	q_1
q_2	q_3	q_1
$*q_3$	q_3	q_2

Compute:

- Regular expressions for all R^0_{ij}
- Regular expressions for all R^1_{ij}

5. (**5 MARKS**) Convert to NFA (all over $\{0, 1\}$) without comment:

- (0+1)01
- 00(0+1)*

6. (**4 MARKS**) Convert each of the immediately previous two NFA (problem #5) to a FA.

7. (**5 MARKS**) Prove that the following is not a regular language: Over $\{0, 1, 2\}$: The set $\{0^n 1^m 2^n : m \geq 0 \wedge n \geq 0\}$