COSC 2001(A and B) 3.0—Fall 2001

Date: Sep 25, 2001
Due: Oct 16, 2001

Problem Set No. 1

Papers *must* **be typed or word-processed (the "*must*" does not apply to diagrams)**, and deposited to a course drop-box on the due date.

▶ Due **time**, and **location** of this box, will be announced soon by Web-posting! ◀

In this Problem Set it is allowed—but not required!—to submit **ONE joint paper that has a total of TWO co-authors from the same section**. The same mark, as assigned to such a joint paper, will be given to **each** of its two authors.

▶ <u>**IFF**</u> you are submitting Problem Set #1 ***with*** a partner, then you ***must*** notify us as described below, in items **Prtnr1.–Prtnr4.:**

Prtnr1. Make a file called "partner" (no quotes). [Please do ***not*** call it "Partner" or "PARTNER" or "a1partner" or anything other than just "partner"].

Prtnr2. Put in it your name and "prism" login, ***and*** the name and prism login of your partner as well.

Prtnr3. Give the following command on prism

"**submit 2001 a1 partner**"

NOT later than Oct. 2, 2001.

Prtnr4. Only ***one*** submission (**Prtnr3.**, above) ***per pair*** please! ◀

If you do NOT plan to work with a partner please do NOT submit any co-author information!

(1) This teamwork is **strictly for "declared" pairs**, and strictly for Problem Set #1. Teamwork may not be allowed on later assignments.

(2) Any strong similarity between different papers will be **seriously frowned upon**. (To learn more about this issue please follow the link "**Senate Policies**" found on the URL: http://www.cs.yorku.ca/∼gt/courses/)

When we ask for a DFA, please design one directly (not through the NFA-to-DFA construction).

1. Design a DFA over $\{0, 1\}$ that accepts exactly all the strings of **length** $3k+1$ for some natural number[†] k.

E.g., 0, 0110, 0000 are all in. 00, 000, 01101 are not.

2. Design a DFA over $\{0, 1\}$ that accepts exactly all the strings whose digits (or "bits") have sum equal to $3k + 1$ for some natural number k.

For example, 1, 100, 1111 are in. 11, 0, 111 are not.

Hint and Requirement. Bad news first: You **must** prove that your automaton works. Good news: You can do that by induction. The DFA will have three states, q_0, q_1, q_3. **If** designed correctly, then the following will be true: "starting on q_0 on an input x the DFA will halt on q_i **iff** the sum of digits of x is $3k + i$ ($i = 0, 1$, or 2)." Prove this quoted statement by induction on string length $|x|$. Note that you go from $|x| = n$ to $|y| = n + 1$ in two ways: $y = x0$ or $y = x1$. Be mindful of the "iff". By the way, granting that the statement is correct, q_1 obviously is the only appropriate final state, right?

3. Text, **Exercises**:

- **(A) p.54: #2.2.3**;
- **(B) p.67: #2.3.4(b)**;
- **(C) p.80: #2.5.3(c)**;
- **(D) p.90: #3.1.4(b)**;
- **(E) p.106: #3.2.3**;
- **(F) p.106: #3.2.4(c)**;
- **(G) p.121: #3.4.4**;
- **(H) p.129: #4.1.1(b,e)**;
- **(I) p.130: #4.1.2(b)**;

[†] To avoid any embarrassment, 0 *is* a natural number.