# Compiler Construction/Fall 2014/Homework 2

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Assigned Thursday 9/11/2014, due Thursday 9/18/2014 at 8am

### Reading Assignments

- For lecture on 9/11/2014: Dragon book 3.1–3.4,3.6-3.7 (50 pages); HACS handout 1 and 2 (the H1 and H2 links on the course schedule)
- For lecture on 9/18/2014: Dragon book 2.4 + 4.1–4.4 (50 pages); HACS handout 3 (the H3 link on the course schedule)

### Homework Assignments

The following assignments should be submitted[1] for a maximum of 30 points.

## 1 Regular Expressions

**Question 1.1** (From informal description to (extended) regular expression, 4 points)**.** Write a regular expression for a language that describe all strings of lowercase letters that contains the five vowels (a, e, i, o, u) in order, and exactly one time. For example, a valid string is

"s **a** b **e** g g **i** **o** n m b **u** w v v l"

**Question 1.2** (From extended regular expression to basic regular expression, 5 points)**.** Describe informally the kind of pattern that matches the following extended regular expression:

```
[b-d]a?e+
```

and rewrite it using only the basic (not extended) features of formal regular expressions. For example, character classes `[···]`, positive closures `+`, and optionals `?` are not basic features, and should be expressed using only the basic taxonomy instead.

## 2 Finite State Automata

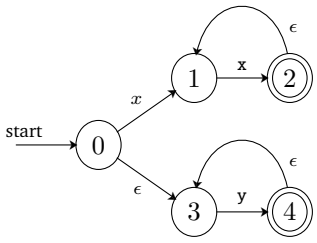
**Question 2.1** (From regular expression to NFA, 5 points)**.** Consider the following regular expression:

```
a((b|c)d+)*
```

Show an NFA as a transition diagram that recognizes/accepts the same language. *Hint: see Example 3.24, p.161.*

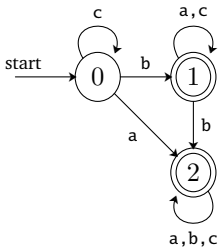
[1] To submit homeworks, log into `home.nyu.edu`, go to Academic → NYU Classes → Compiler Construction → Assignments, and upload your file with answers there. Don't forget to click "submit" before the deadline, just "upload" is not enough.

**Question 2.2** (From NFA to DFA, 5 points). Consider the following NFA:




Describe informally the kind of strings that is accepted by this NFA, and show a DFA that accepts the same language. *Hint: see Example 3.21, p.154.*

**Question 2.3** (From DFA to regular expression, 5 points). Consider the following DFA:




Describe informally the kind of strings that is accepted by this DFA, and show a regular expression that accepts the same language.

# 3 HACS

**Question 3.1** (6 points). Retrieve `http://krisrose.net/hacs.zip` and unpack it. Follow the instructions in the "Getting started" section of the H1 handout, and compile your own *first.run* compiler. Run the compiler on the program `{ celsius := 20; fahrenheit := celsius * 1.8 + 32; }`