

COS126 Regular Expressions, DFAs (Booksite §7.2, 7.3)

See also the online chapter in the lecture page Reading column.

Part 1

Consider the regular expression $((C|D|M|N|P|T)A)^*$

- Is PAPA generated by this RE? Is MAMAN? Is NAPA? Is TAMPA? **NAPA is, but MAMAN and TAMPA are not**
- What two country names can be generated? **PANAMA and CANADA**

Part 2 — RElay Race

Write regular expressions for the following languages.

1. all binary strings $(0|1)^*$
2. all non-empty binary strings $(0|1)(0|1)^*$
3. all binary strings beginning and ending with 1 $1|1(0|1)^*1$
4. all binary strings ending with 00 (divisible by 4) $(0|1)^*00$
5. all binary strings with at least three 1s $0^*10^*10^*1(0|1)^*$, $(0|1)^*1(0|1)^*1(0|1)^*1(0|1)^*$, etc

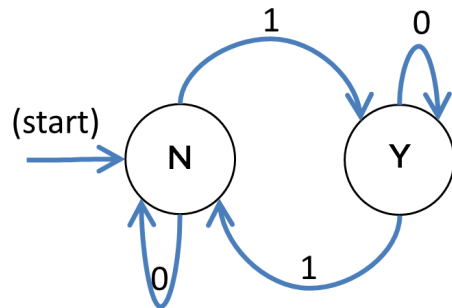
Part 3

What does $(0^*10^*10^*)^*$ generate? (Describe this set of strings in English) **All binary strings with an even number of 1s, except that it misses those strings consisting of just one or more 0s**

Bonus

Hard bonus: can we generate set of all binary integers divisible by 3? **Yes**

Part 4



- Is 01101 accepted by this DFA? Is 11? **01101 is, 11 is not**
- What is an English description for the set of all strings it accepts? **All binary strings with an odd number of 1s**
- (Optional) What is a Regular Expression description for the set of all strings it accepts? **$0^*10^*(0^*10^*10^*)^*$ (other formulations possible)**

Part 5

Write 5 DFAs that accept the 5 languages from part 1: **see next page**


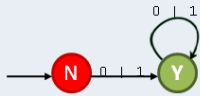
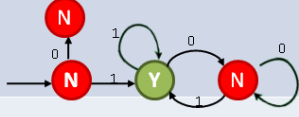
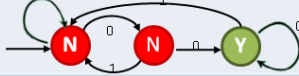

1. all binary strings
2. all non-empty binary strings
3. all binary strings beginning and ending with 1
4. all binary strings ending with 00 (divisible by 4)
5. all binary strings with at least three 1s

Bonus



Write a DFA that accepts the set of all Java double literals. Use the RE

$(\backslash+|-|)([0-9]+(\backslash\.[0-9]*)|\backslash\.[0-9]+)(|(E|e)(\backslash+|-|)[0-9]+)$

Recommended RE/DFA exercises from the exam archive: Fall 2009, Exam 2, question 2; Spring 2013, Exam 2, question 4

| Language | Regular Expression | DFA |
|--|-----------------------------------|--|
| All binary strings | $(0 1)^*$ |  |
| All binary strings except empty string | $(0 1)(0 1)^*$ |  |
| Begins with 1, ends with 1 | $1 1(0 1)^*1$ |  |
| Ends with 00 | $(0 1)^*00$ |  |
| Contains at least three 1s | $(0 1)^*1(0 1)^*1(0 1)^*1(0 1)^*$ |  |

Legend

-  Non-Accepting State
-  Accepting State