MA/CSSE 474 **Homework #15** 63 points **Updated for Spring, 2018**

See some Piazza questions and answers from a previous term at the end of this document.

Key:

(No symbol) Not required to be turned in. Just be sure that you can do it.
(t -7) To be turned in and graded, worth 7 points.

1. (t-6-3) 17.11 First show that it is a subset of D by showing a construction that creates a TM from a DFSM. Then show that it is a *proper* subset.
2. (t-24) 17.12 (6 points for each of the four parts)

   Note on 17.12a: { [<x>, <f(x)>], x∈ℕ}, where <x> means "the binary encoding of integer x" and <f(x)> means "the binary encoding of integer f(x)"

   17.12b,c: Do these constructions for a general function-computing TM, not specifically for the successor function.

   Hint for part c: You might find the concept of "dovetailing" helpful for this problem. If you have not seen that technique before, this reference will probably help:

   <http://lambda-the-ultimate.org/node/322

3. (t-3) 17.13
4. (t-9) 18.1a
5. (t-9) 18.1b
6. (t-9) A TM M has tape alphabet { □, a, b} (this is the order used in the encoding <M>).

<M> = (q00,a00,q00,a00, →), (q00,a10,q01,a10,→), (q00,a01,y10,a10, ←), (q01,a01,q00,a10,→), (q01,a10,n11,a01, ←)

   (a) (6) Provide a transition diagram or a transition table for the TM M.
   (b) (3) For each of the following outcomes of running M, provide a short string of a's and b's that is
   accepted by M,
   rejected by M,
   neither.

Piazza questions and answers from a previous term

Q: When is epsilon/empty string needed for NDFSMs?

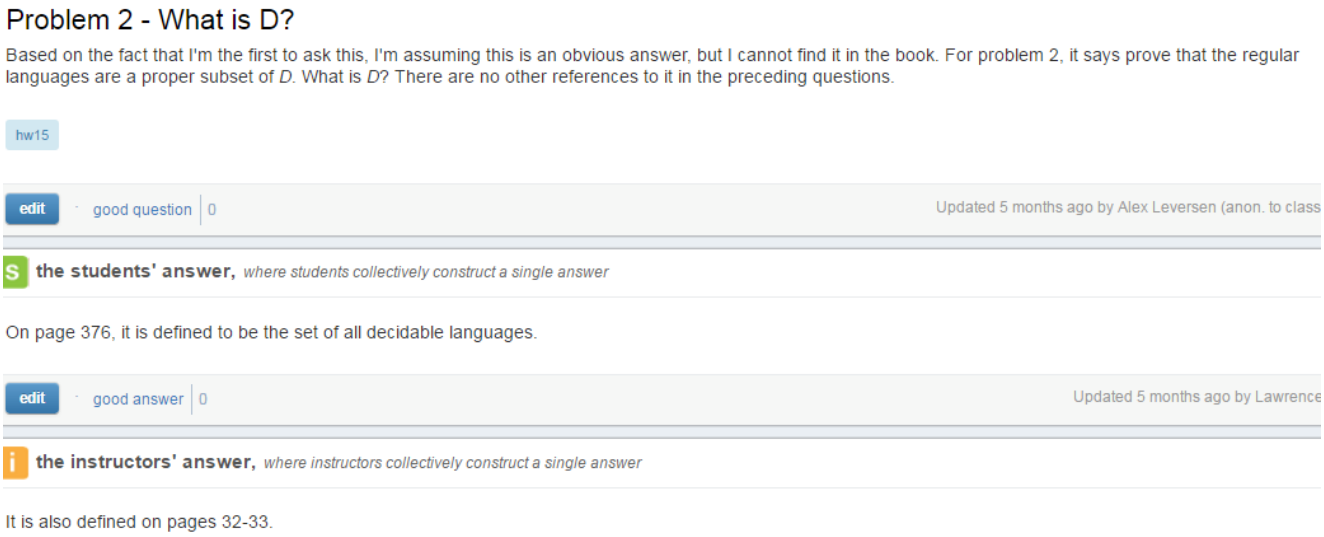
I've noticed that we sometimes use epsilon/empty string in NDFSMs to go from state to state and sometimes not.
How do we know when we need the empty string and when we don't?

A: t is never necessary to use include epsilon transitions when we create a NDFSM .
In fact we can easily prove that given a NDFSM that includes epsilon transitions, w can make an equivalent NDtFSA that does not include any epsilon transitions.

So epsilon transitions are simply a matter of convenience, as is non-determinism itself. Use them when they make it easier to create a machine that accepts a particular language.

This question is about problem 1.

There has been some renumbering since this question was asked.



Problem 2 - What is D?

Based on the fact that I'm the first to ask this, I'm assuming this is an obvious answer, but I cannot find it in the book. For problem 2, it says prove that the regular languages are a proper subset of *D*. What is *D*? There are no other references to it in the preceding questions.

hw15

edit · good question | 0 — Updated 5 months ago by Alex Leversen (anon. to class

the students' answer, *where students collectively construct a single answer*

On page 376, it is defined to be the set of all decidable languages.

edit · good answer | 0 — Updated 5 months ago by Lawrence

the instructors' answer, *where instructors collectively construct a single answer*

It is also defined on pages 32-33.

HW15 2a) input form?

So is the input of M' something of the form [x,y] where x would be the input for M and y is what we'd check with the output of M.

OR

Is the input of M' supposed to be the whole graph, ie, the input of the form [x1,y1], [x2,y2]...?

I wasn't really sure from the question since it seems that M' decides the **graph** of the function, which I thought meant the whole language L's input and output would be the input for M

Answer: It is the former, a single pair. It can't be the entire graph, since that is infinite.

Hint for HW15 (Problem 2c)

You might find the concept of "dovetailing" helpful for this problem. If you have not seen that technique before, this reference will probably help:

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HW15 #6 and #7 Approach?

What is the expected format for these two problems? Do we need to actually create a decision procedure that decides whether the description of the language satisfies the given constraints? Or are we doing something more vague, like some sort of proof that shows that the language is in D without actually defining a decision procedure? In either case, how do we go about doing this?

Answer: Your answer should be the decision procedure.