

Homework #1

Due: Wednesday, January 14th, 2015, 11:59 PM

Problem 1 Sign up for an account on Automata Tutor, at <http://automatatutor.com>. If you are a UCSD student, use your official UCSD e-mail for your account, so that we know whom to assign credit to. If you are an extension student, use the same e-mail address you gave us to use for GradeSource. Enroll in CSE 105’s Automata Tutor section, which has Course ID “33UCSDCSE” and password “UAKRXM1Y”. On automata tutor, there is only one class listed under Prof. Shacham. That’s the right class even if you are with Prof. Micciancio.

You may practice designing automata using the practice problem sets.

a–e. Complete the five problems that constitute CSE 105’s HW1 on Automata Tutor. Notice that you may have only a limited number of chances to submit/revise your solution.

If you don’t see any problem listed yet, just be patient, we will add the problems soon.

Problem 2 Proofs by induction. This problem is just a refresher of standard mathematical notation and simple proofs by induction, which are both essential tools in the study of automata and computability theory. Your solution will be graded both for correctness and clarity.

Prove, by induction on n , that

$$\sum_{k=1}^n (2k) = n^2 + n,$$

i.e., the sum of the first n even positive integers equals $n^2 + n$.

Submit your solution as a pdf file `HW12.pdf` using Bundle. Your solution should be typeset. If using LaTeX to typeset your proof, start from the `HW12.tex` template file on the course webpage. If not, make sure you include your name, student id, and collaboration disclosure at the beginning of your writeup.

Problem 3 Haskell. This is a very simple programming exercise, meant to familiarize yourself with the Haskell programming language and the `ghc` compiler. To start with, read the instructions on the course webpage/calendar on using Haskell.

The task is to write (and compile) a haskell program that computes the function from problem 2. More specifically, on input an integer $n \geq 0$, the program should output the sum of the first n even numbers.

Use the starter file `HW13.hs` provided on the course webpage, and complete the definition of the program `HW13` as directed by the comments in the file. You should submit your modified file `HW13.hs` using Bundle.

You can test your solution by first compiling it with the command `ghc HW13.hs`. If compilation is successful, move on and run the test program with the command `runghc HW13-test.hs`. You can look at the test program (it is very simple): it computes your function `hw13` on 100 input values, and checks if they all produce the expected result, according to the formula from problem 2. The test program will print “True” if all results are correct, and “False” otherwise. (Alternatively, you can also test your program by loading it in the interpreter with the command `ghci HW13.hs`, and then evaluating `hw13 n` on any input n of your choice.)

Problem 4 Using JFLAP. The aim of this problem is just to make sure you can run JFLAP on your computer. Download JFLAP from the webpage <http://www.jflap.com> and start it on your computer following the instructions on the JFLAP webpage. You can also follow the tutorial on that webpage to familiarize yourself with the program.

Then use JFLAP to draw the DFA $M = (Q, \Sigma, \delta, s, F)$ where

- $Q = \{A, B, C\}$,
- $\Sigma = \{0, 1\}$,
- $s = A$,
- $F = \{B, C\}$, and
- $\delta: Q \times \Sigma \rightarrow Q$ is the transition function specified by the following table

δ	0	1
A	A	B
B	B	C
C	A	A

Save the automaton into a file `HW14.jff` and submit it using Bundle.