INSTRUCTIONS

Homework solutions should be neatly written or typed and submitted through Gradescope. No work can be accepted outside of this system, and no late work will be accepted. Please ensure that your submission is legible (neatly written and not too faint) or your homework may not be graded. You may update your submission as many times as you’d like up to the deadline. Only the most recent submission will be graded.

Thirty problems from homework assignments will be graded randomly throughout the quarter. You will not know in advance which problems, if any, will be graded on each assignment.

You may consult your textbook, class notes, lecture slides, instructors, TAs, and tutors for help with homework. You may also discuss homework questions with classmates, but you may not share written work with classmates. You must write up your solutions alone, in your own words. The assignments have been developed to facilitate your learning and to provide a method for fairly evaluating your knowledge and abilities, not the knowledge and abilities of others. To facilitate learning, you are authorized to discuss assignments with others; however, to ensure fair evaluations, you are not authorized to view or share written work with another person, or to write your submission in collaboration with another person. You should not look for answers to homework problems in other texts or sources, including the internet.

Do not post about homework questions on Piazza. For help with homework, please consult the course textbook, lecture slides, class notes, and podcasts, or come visit us in office hours.

READING: Sipser Chapter 0
Start out by making sure you are set up for this quarter. To do:

- Set up your iClicker/REEF for class participation. See the class website for instructions.
- Sign up for Piazza at: piazza.com/ucsd/winter2017/cse105
- Access Gradescope with your @ucsd.edu email address. You should have been automatically added to our class on Gradescope. If not, you can self-enroll with entry code M4Z73M.
- Download JFLAP. See the class website for instructions.

1. *(Sipser 0.1 and 0.4)* Sets can be precisely described formally, using set notation, or informally, using English. For parts (a) through (f), describe each set formally. For parts (g) through (l), describe each set informally as succinctly as possible. We will define the natural numbers \( \mathbb{N} \) as the positive integers together with 0.

(a) The set containing the numbers 1, 10, and 100.
(b) The set containing all integers that are greater than 5.
(c) The set containing all natural numbers that are less than 5.
(d) The set containing the string aba.
(e) The set containing the empty string.
(f) The set containing nothing at all.
(g) \( \{1, 3, 5, 7, \ldots \} \)
(h) \( \{\ldots, -4, -2, 0, 2, 4, \ldots \} \)
(i) \( \{n|n = 2m \text{ for some } m \text{ in } \mathbb{N}\} \)
(j) \( \{n|n = 2m \text{ for some } m \text{ in } \mathbb{N} \text{ and } n = 3k \text{ for some } k \text{ in } \mathbb{N}\} \)
(k) \( \{w|w \text{ is a string of 0s and 1s and } w \text{ equals the reverse of } w\} \)
(l) \( \{n|n \text{ is an integer and } n = n + 1\} \)

2. A gumball machine sells gumballs for 30 cents. The machine accepts nickels, dimes, and quarters only. Once 30 cents or more has been inserted, the machine releases a single gumball. Show how to model this gumball machine using a finite state machine. The machine should release a gumball after any sequence of coins totaling at least 30 cents has been inserted. For example, if you input 60 cents, the machine releases only one gumball.

Draw your finite state machine. Also describe briefly in a few sentences the logic behind your machine, including what the states and transitions represent.