Homework 0

Due: 3 October, 2025 6pm PT

This homework is on prerequisite knowledge that you are expected to know from intro classes (or if not, pick up at the beginning of the course). Even though this homework is only **graded on completion**, you should submit it so that we can make sure that you have all the prerequisite knowledge to succeed in this course.

Complete and submit this homework individually (although collaboration is allowed to the extent described in the course missive). We will only do grouped homeworks for Homeworks 1-4.

Problem 1

(2 ✓ total)

1. We want ECS122A to be useful to you. As part of this process, write a couple sentences (or more if you like) describing your goals for this class—what do you hope to gain from the time you put into ECS122A?
2. Sign the collaboration policy on Canvas (it is a Canvas assignment where you submit "I agree".)
3. Are you allowed to ask ChatGPT or any online resources for homework solutions? Select one of the following: (A) Yes (B) No (C) Yes, but only if I cite the source, and make sure I understand the solution that is turned in.
4. Are you allowed to collaborate with classmates (other than your homework partners) on homework problems and write the solutions together? (A) Yes (B) No (C) Yes, but only if I name the other people I worked with, and I make sure I understand the solution that is turned in.

Problem 2

(3 ✓s)

Sort the following functions by order of growth from slowest to fastest ("big-O" notation). For each pair of adjacent functions in your list, please write one sentence describing (informally is fine) why you ordered them as you did.

(a) $7n^3 - 10n$	(b) $4n^2$	(c) n
(d) $n^{8621909}$	(e) 3^n	(f) $e^{\log \log n}$
(g) $n^{\log n}$	(h) $6n \log n$	

(**Hint**: Remember that $e^x \leq e^y$ if and only if $x \leq y$, and also that $a^b = e^{b \log a}$.)

Problem 3

(3 ✓s total)

1. (1 ✓) Given the recurrence $T_1(n) = 2 \cdot T_1(n-1) + 1$ where $T_1(0) = 0$, carefully pick (yes. actually pick.) two positive integers a and b and prove by induction that $T_1(n) \leq a \cdot 2^n - b$. (Be sure to state your induction hypothesis clearly!) Then conclude that $T_1(n) = O(2^n)$.

2. (2 ✓s) Prove by induction that $T_2(n) \leq n \log_2 n$, given that: $T_2(n) = \begin{cases} 2 \cdot T_2\left(\left\lfloor \frac{n}{2} \right\rfloor\right) + n & \text{if } n \geq 2 \\ 0 & \text{if } n = 1 \end{cases}$

   where the notation $\left\lfloor \frac{n}{2} \right\rfloor$ means "round $\frac{n}{2}$ down to the nearest integer."

Problem 4

(2 ✓s)

Complete Coding Assignment 0 (which is algorithmically trivial) to familiarize yourself with Gradescope submissions and autograding.