cs473: Algorithms Assigned: *Thu., Aug. 27, 2020*

Problem Set #0 (v2)

Prof. Michael A. Forbes Due: *Thu., Sep. 3, 2020 (5:00pm)*

Some reminders about logistics.

- **Submission Policy:** See the course webpage for how to submit your pset via gradescope.
- **Collaboration Policy:** For *this* problem set, each student must work independently and submit their *own* solutions. For the *other* problem sets, this rule will not apply. See the course webpage for more details.
- **Late Policy:** Late psets are not accepted. Instead, we will drop several of your lowest pset problem scores; see the course webpage for more details.

All problems are of equal value.

1. Solve the following recurrences, by giving an asymptotically tight bound of the form $\Theta(f(n))$ where $f(n)$ is a standard and well-known function. A *proof* is only required for the last part. Assume as a base case that $T(n) = 1$ for $n \leq 100$.
   (a) $T(n) = 3T(n-1) + 1$.
   (b) $T(n) = 3T(n^{1/2}) + \log n$.
   (c) $T(n) = 5T(n/3) + n$.
   (d) $T(n) = T(n/3) + n^2$.
   (e) $T(n) = 3T(n/3) + 3T(n/4) + n^2$.
   (f) *Prove* that $T(n) = O(n \log n)$, where $T(n)$ is given by the following recurrence.

$$T(n) = n + \frac{1}{n} \sum_{i=1}^{n-1} (T(i) + T(n-i-1)) \ .$$

2. Erickson #23 (http://jeffe.cs.illinois.edu/teaching/algorithms/book/05-graphs.pdf).
3. Erickson Directors Cut 1, #1 (http://jeffe.cs.illinois.edu/teaching/algorithms/notes/01-random.pdf).