University of Waterloo
CS240E, Winter 2025
Written Assignment 2 Post-Mortem

This document goes over common errors and general performance on the assignment. We create it using feedback from the graders, and it is meant to be used as a resource to understand common areas that we can improve in.

Question 1   [1+1+7=9 marks]

- This question was done well.

Question 2   [2+5=7 marks]

- This question was done well.

- Many solutions used the fact that it is possible to find an instance that achieves $\Theta(n^2)$ runtime, thereby proving both parts at once. Proving this was originally going to be part of the question, but it was changed to allow for a recursion tree argument in part (b), which we thought would be easier. This may have been an incorrect assumption on our part.

Question 3   [6+3=9 marks]

- In part (a), some solutions treated the list as an array, assuming that its elements could be looked up in constant time.

- Almost all solutions for (b) had the right idea that Quirky's algorithm would contradict the lower bound on the time for sorting, but some did not fully explain how traversing the tree accomplishes this.

Question 4   [3+3+3+6(+5)=15(+5) marks]

- Part (a) was done well.

- In parts (b) and (c), some solutions showed an O-bound instead of the specified Θ-bound.

- In part (d), some solutions failed to fully simplify the expression for the difference in potential. Some also did not clearly define time units for the amortized analysis.

- Most attempted solutions to the bonus part (e) were correct, but some did not give enough detail as to why their new potential function works.

Question 5 [2+3+2+3=10 marks]

- In part (a), some solutions only rephrased the problem statement, and some attempted to use proof by contrapositive but formed the contrapositive incorrectly.

- In part (b), many solutions computed a logarithm at each level of the tree, resulting in a $\Theta((\log n)^2)$ runtime.

- Part (c) was done well.

- In part (d), some solutions had the wrong expression for the height of a perfectly size-balanced tree, but this was not penalized if it did not affect the argument's correctness.