

University of Waterloo

CS240 Fall 2022

Assignment 2 Post-Mortem

This document goes over common errors and general student performance on the assignment questions. We put this together using feedback from the graders once they are done marking. It is meant to be used as a resource to understand what we look at while marking and some common areas where students can improve in.

Question 1 [5+5+5=15 marks]

- For part a), some students forgot to perform `fix-up` after the second insertion.
- For part c), many students forgot to show the heap after performing the first `deleteMax` operation.

Question 2 [10 marks]

- Many students used brute force instead of a recurrence relation to solve the problem, which led to errors in the cases of $n = 7, 8$ as the size of the heap was quite large.
- Some students had minor calculation errors.

Question 3 [10 marks]

- Many students did not continue swapping $A[i]$ with $A[A[i].key]$ until $A[i]$ is equal to i in their algorithm.
- Many students incorrectly stated the worst-case number of iterations as n instead of $2n$ in their run-time analysis.
- Some non-LaTeX submissions were hard to understand.

Question 4 [4+6=10 marks]

- For part a):
 - Many students did not calculate the probability rigorously using mathematical equations.
 - Many students did not provide a randomized algorithm, some of these students selected and returned a specific index instead of a random one (e.g. Some students either returned the first element, the middle element, or the last element).
- For part b):

- Many students did not include a correctness proof.
- Many students did not provide enough detail in their runtime analysis.
- Many students provided incorrect algorithms, such as deterministic algorithms or algorithms using quick-select.
- Some student did not calculate the bound of expected number of iterations correctly.

Question 5 [6 marks]

- Many students did not discuss the edge case when $k = 0$, when the runtime is $O(k+1) = O(1)$, as this is the case that makes the $+1$ part essential.
- Many students had incorrect/incomplete or very non-formal runtime analysis. Common errors include discussing only the base case of the recursion, not considering the point where the recursive calls stop, and stating the incorrect number of total nodes visited.
- Many students reported the number of nodes with value $\geq c$ instead of which values they were.
- Some students had incorrect or missing recursive calls on both the left and right child of the current node.
- Some students returned at the incorrect place in their algorithm.