University of Waterloo
CS240E, Winter 2022
Assignment 4 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 kind of stuff we look at while marking and some common areas where students can improve in.

Question 1 [3 marks]

- Generally well done. Some students realized X_i had a Binomial distribution with parameters n and $p = \frac{1}{M}$.

Question 2 [1 + 2 + 2 + 5 = 10 marks]

- a) was well done.
- b) Some students stated the quadratic form of the hash function but didn't justify it.
- c) and d) A lot of students made modular arithmetic errors.

Question 3 [2 + 4 + 5 + 2 = 13 marks]

- a) One of the most common errors was that students used $log(n)$ (or 2^x) directly without even discussing the runtime for it.
- b) Generally well done.
- c) Some students had a proof that works for exactly 1 bit difference in the keys, but not more than that.
- d) Several students didn't talk about one of the runtime or space.

Question 4 [4 + 3 + 2 + 3 = 12 marks]

- a) Generally well done.
- b) Several students assumed the algorithm works in a similar way to part a. In particular lots of them assumed it is still a kd-tree.

- c) Generally well done.
- d) Just stating a "balanced BST" and not specifying what kind of "balanced BST" - how the BST stays balanced influences the runtime and impacts how the extra fields need to be updated on insert/delete.

Question 5 [5 + 5 + 2 = 12 marks]

- a) (no deduction) Some students stated "inside nodes" when they meant "topmost inside nodes".
- b) Generally well done.
- c) Some students tried to store the sizes inside a priority search tree and just assumed it could be used like in part a/b. (also, a few students thought 3-sided meant the points were in 3D instead).

Question 6 [(+5) marks]

- Most students didn't answer this. Of the ones that did, either their approach doesn't actually work or they had a O(n log n) solution which they analyzed wrong and got O(n).
- Some students that did it were a bit hand-wavy in their justification that the height is ceil(log n).