University of Waterloo
CS240 Fall 2022
Assignment 3 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 for while marking, as well as some common areas that students can improve in.

Question 1   [2+5+5=12 Marks]

- For parts (a), (b), and (c), some students mistakenly wrote the heights of the subtrees in the node, instead of the balance factors.

- For parts (b) and/or (c), some students forgot to include the balance factors for each node.

Question 2   [4+4=8 Marks]

- For part (a), some students did not apply the correct procedure when performing a rotation.

- For part (b), students were expected to derive the relative heights of the subtrees A, B, C, and D, and use these values to determine the balance factors for the nodes in the resulting tree. Students who got this question wrong either incorrectly derived the relative heights, or assumed all the subtrees to have the same height.

Question 3   [6 Marks]

- A common error here was providing the incorrect height of a tree with just one node (which would have height 0).

- When it came to the runtime analysis, some students did not provide enough detail in their justifications. In particular, a few answers omitted the fact that the height of an AVL tree is in $O(\log n)$, which would give the required traversal time.

- Some answers were also missing a justification of correctness.

Question 4   [6+6=12 Marks]

- For part (a), a common error was providing the incorrect number of levels (the sentinel-only level was missing, or extra levels had been added).

- For part (a), some answers did not insert the nodes properly (in the correct order, or with the correct number of levels).

- For part (b), some answers which didn't receive full marks failed to provide the set of keys in S_1 and S_2. Other incorrect/partially correct answers forgot to mention the sizes of the sets.

- For part (b), another frequent mistake was not providing the floors of the keys in S_1 or S_2 (to ensure that they are integers).

Question 5   [6+7+7=20 Marks]

- For part (a), many answers that did not receive full marks did not contain sufficient justification. Some answers directly gave a worst-case number of comparisons of $n-1$ without using a decision tree, while others drew a decision tree without drawing the correct conclusions.

- For part (a), a common error was forgetting that there was a third possible outcome – a tie. This led to an incorrect final expression for the maximum number of comparisons.

- For part (a), some students who got this question wrong gave incorrect calculations for the number of strong-weak player combinations. Incorrect answers included using the $\binom{n}{r}$ formula directly or some other incorrect derivation. Other incorrect answers here included providing an O bound instead of an exact expression, or giving a final answer that was off by 1.

- For part (b), some answers exceeded the correct number of worst-case contests (3).

- For part (b), a common error among students who got this question wrong was trying to design an algorithm to fit their incorrect answer for part (a).

- For part (c), a frequent mistake here was not giving sufficient justification of the worst-case runtime.

- For part (c), some students extended their O expressions to a Θ bound without deriving the Ω bound.

Question 6   [2+2+2=6 Marks]

- For part (a), it was observed that some students followed an incorrect branch ordering. The question asked for a left-right branch ordering of \$, 0, and 1.

- For parts (b) and (c), a common error that students made was to start the compressed trie from index 0 – in compressed tries, the root node contains the first index at which the same character is not seen across all strings. In this case, that would be at indices 2 and 1 for parts (b) and (c) respectively. This extended to the other internal nodes as well.

- While this was not a serious mistake, some students accidentally omitted/added some digits in their final strings.

- For one or more parts of the question, some students forgot to label the edges of their tries.

- Another mistake was not including the final strings as leaf nodes.