

University of Waterloo
CS240 Winter 2023
Assignment 3 Post Mortem

Question 1 [0+4+3+6=13 Marks]

- Marking for this question was strict, since it was weighted rather heavily based on its low relative difficulty. That being said, this question was answered well by many students.
- For part (c), the answers that did not receive full credit failed to recognize/mention that there would be a rotation if node 40 was swapped with its predecessor but not with its successor.
- For parts (b) and (d), significant deductions were given if the final answers did not include balance factors. Many wrong answers lost marks because of this. If the AVL tree showed the heights of a subtree instead, then the deduction was not as severe.

Question 2 [3+3+3=9 Marks]

- For part (a) – while a proof by induction was not necessary – some students did not provide sufficient detail/justification in non-induction answers, which led to some deductions.
- For part (b), a lot of students only provided one base case; two were required since the sum of the two previous minimum AVL trees were being used.

Question 3 [3+4=7 Marks]

- For part (a), students who lost marks either assumed that $h_a \leq h_b$ without considering the symmetric case or gave an algorithm that would not meet the runtime requirements.
- For part (b), many students who got this question wrong followed the same procedure as in (a), except that they claimed to then be performing a finite number of rotations without giving a tight bound on the number of restructures. This missing detail received a deduction.

Question 4 [4+4=8 Marks]

- For part (a), some students claimed that the worst case would be realized when $k = n$, and then solved for this.

- For part (b), the most common error was not providing justification for the final answer and/or not giving the final answer as a Θ bound.

Question 5 [3+4+4=11 Marks]

- For part (a), a frequent mistake among answers that lost marks was calculating the midpoint for the third iteration. This is not computed, since before this point, the algorithm would verify that $A[r] = 120$ and then terminate.
- For part (b), some answers that lost marks forgot to mention that the while loop would begin at most 2 iterations, instead saying that the number of iterations was constant.
- For part (b), another error was not considering the cases where the key is in the array and where it is not in the array separately.
- For part (c), a mistake that was noticed frequently was searching for the last element – this would cause the while loop to terminate before the first midpoint is calculated.

Question 6 [2+2+3+3=10 Marks]

- This question was generally answered well by students.
- The common errors across all parts included missing keys or edge labels, as well as incorrect leaves and labels.
- Another common error, though not as severe, was ordering the children of a node in a different order apart from $0, 1$, which was what was asked for in the question.
- For parts (a) and (c), some students did not store the final string in their leaf nodes.
- For parts (b) and (d), many incorrect answers forgot to label the internal nodes.
- For parts (b) and (d), some answers showed an uncompressed trie instead of the compressed variant.