

University of Waterloo
CS240E, Spring 2026
Written Assignment 3 Post-Mortem

Question 1 [8 marks]

Question 2 [3+5=8 marks]

Question 3 [2+6=8 marks]

Almost no one made mistakes in the first 3 questions.

Question 4 [4 marks]

The tightest possible bound is $h = \lfloor \log \log n \rfloor + 2$, for **any** n - if you did not get this bound, check for math errors. Also, the question asks that you "make no assumptions on the divisibility of n ", and "show that your bound is tight for infinitely many values of n ". Missing either of these will result in lost marks.

Question 5 [1+2+9+5+4=21 marks]

a) Well done.

b) The smallest possible constant is $c = \frac{3}{2}$.

Other than math errors, a common mistake is forgetting that zig-zig rotations result in a chain of $x \rightarrow p \rightarrow g$, which means the height is $\leq \max(2, \text{subtree-height} + 1)$. A lot of you missed the 2 here, which results in a bound of $c = \frac{1}{2}$ or $c = 1$.

c) Most people had a correct construction, but some did not show the $\Theta(n^2)$ bound.

d) Do not use 5(b) for this question - it does not work.

Also, the given tree T may already have some potential. It does not start as an empty tree. It is not hard to see $\Phi(T) \leq n \log n$ using the same potential function seen in class.

Question 6 [5 marks]

As shown in tutorial 8, a pruned trie is basically the same structure as MSD radix sort. So solutions related to either of these are accepted. There's also a funny LSD radix sort solution.