

**University of Waterloo**  
**CS240R Spring 2017**  
**Assignment 4 Post mortem**

Written Friday, July 21st

## Problem 1

In part a), the common mistake was students not including  $d$  in their space usage, as the buckets used by radix sort require  $\Theta(d)$  space.

The most common error in part b) was failing to give an upper bound on the value of  $k$ . There were also some students who did not include  $k$ ,  $d$ ,  $\ell_{max}$ , or  $\ell_{avg}$  in their analysis even though they wrote that the runtime and space usage required those terms but decided to simplify the order to just  $O(n)$  in the end.

For part c), many students only considered the greater space usage of tries instead of noting the runtime difference between  $\ell_{avg}$  and  $\ell_{max}$  as well.

## Problem 2

Most students either got the correct answer or didn't at all. For part a), students who realized that the maximum height of T was related to the length of the longest string usually got  $\frac{c \log n}{s}$  correctly.

In part b), a few students got different answers for the maximum space usage of the arrays and the maximum space usage of T, even though they were the same. Some students also put extra terms into their answer such as  $O((2n + 1)x)$  when order notation only requires the term that grows the fastest.

## Problem 3

Done well by every student, with the exception of a few misunderstandings about the formula for double hashing and which element gets kicked out on a collision in Cuckoo hashing.

## Problem 4

Part a) was done well by almost every student.

The most common mistake in part b) was not specifying the total number of probes.

In part c, common errors were: not showing an example hash function and hash table, or trying to show  $\Omega(n^2)$  probes across multiple inserts rather than 1 insert.

Some students did not realize that the ordering property of this question's modified open addressing allowed the program to determine if a search would fail by a comparison between the searched key and the probed key and seeing if the probed key was larger. As a result, they gave much larger modifications to the search algorithm than was necessary.