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 $k$, $d$, $\ell_{\text{max}}$, or $\ell_{\text{avg}}$ 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 $\ell_{\text{avg}}$ and $\ell_{\text{max}}$ 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.