University of Waterloo
CS240, Spring 2021
Assignment 1 Post Mortem

Problem 6 (PQ1) [14 marks]

- When analyzing space complexity you should also use order notation (such as $\mathcal{O}(n)$). Space complexity refers to the space the data structure will need, not the auxiliary space for insert and deleteMax methods.
- A lot of students missed that implementation 3's insert and deleteMax have runtime dependent the largest priority in the queue.
- Some students some of their correctness marks by reusing their implementation for different parts (e.g. using part 1 for both 1 and 3).

What we were looking for (run-time and justification):

Implementation 1:
insert: O(n) - may need to search through the whole list
deleteMax: O(1) - simply remove first node in linked list
Total space: O(n) space

Implementation 2:
insert: O(log n) - same as in course slides
deleteMax: O(log n) - same as in course slides
Total space: O(n) - with dynamic array doubling strategy, the array may be size 2n with at most n empty spaces - this is still O(n)

Let m be the highest priority in the priority queue.
Implementation 3:
insert: O(m) - reallocating array to size m+1 is O(m), insert into a queue at index m is O(1)
deleteMax: O(m) - may take O(m) time to find new highest priority, O(1) to shrink array
Total space: O(m + n) - vector (number of queues and individual elements)