

# MTH 4320 Homework 6

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## Problem 1

*Solution.* If the cell is empty then we can insert with constant time. If the cell is not empty then there is a collision so we need to iterate over the other cells to find an empty one. Therefore, the time complexity of insertion without collision is  $O(1)$  and with collision is  $O(n)$ . If the element is in cell  $i$  then we can search in constant time. If it is not in cell  $i$  then we need to iterate over the other cells to find it. Therefore, the time complexity of searching without collision is  $O(1)$  and with collision is  $O(n)$ . ■

## Problem 2

*Solution.* The algorithm is:

1. Let  $H$  be a hash table with  $k$  cells. The time complexity is  $O(k)$ .
2. For every element in  $L$ : Insert the element to the  $k$ th cell where  $k$  is the key of the element. The time complexity is  $O(1)$ . If the cell is not empty then chain the element. The time complexity is  $O(n)$ .
3. Make a new sorted  $L$  by appending the elements in every cell of  $H$  in order. We have  $n$  elements and  $k$  keys so there are at most  $\frac{n}{k}$  values in every cell of  $H$ . The time complexity is  $O(k) \cdot O(\frac{n}{k}) = O(k \cdot \frac{n}{k}) = O(n)$ .

The time complexity of the algorithm is  $O(n + k)$ . ■

## Problem 3

*Solution.* The algorithm is:

- 1.

The time complexity of the algorithm is  $O(n)$ . ■

## Problem 4

*Solution.* The algorithm is:

- 1.

The time complexity of the algorithm is  $O(n)$ . ■