CS 101 Fall 2020 - Quiz 2-A

9/29/2020 - 20 Minutes **Name:** **ID number:**

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(1) (8 Points) Here is a sorting algorithm in the following.

```
Procedure Sort(A):
  for j = 2 to A.length:
      key = A[j]
      i = j - 1
      while i > 0 and A[i] > key:
          A[i+1] = A[i]
          i = i - 1
      A[i+1] = key
      // Mark
```

- (3 Points) Which sorting algorithm does it describe?
- (5 Points) Given a list as `[31, 4, 59, 26, 41, 58]`, we use the above procedure to sort it. Write down what will the list be like each time when the procedure meets the `Mark`.

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(2) (7 Points) A hash table of size m is used to store n items, with $n \leq m/2$. Open addressing is used for collision resolution.

- (3 Points) Assuming uniform hashing, show that for $i = 1, 2, \ldots, n$, the probability that the ith insertion requires strictly more than k probes is at most 2^{-k}.
- (4 Points) Show that for $i = 1, 2, \ldots, n$, the probability that the kth insertion requires more than $2 \log n$ probes is at most $1/n^2$. (You can use the conclusion in the above question directly.)