State weather the following statements are true or false:

(1) Counting sort is a stable , in place sorting algorithm (T,F)

(2) Radix sort does not work correctly (i.e. doesn't provide the correct output) if we sort each individual digit using insertion sort instead of counting sort. (T,F)

(3) Instead of using counting sort to sort digits in the radix sort algorithm, we can use valid sorting algorithm and radix sort will still sort correctly (T,F)

(4) Given an array of n integers, each belonging to {-1; 0; 1}, we can sort the array in O(n) time in the worst case.(T,F)

(5) Consider as array A [1……..n] of integers in the range 1…….n^2. a number a is a heavy hitter in A if a occurs in A at least n/2 times. Give an efficient algorithm that finds all heavy hitter in a given array A.

(6) Explain why the worst case running time for bucket sort is **Θ (n^2)**? What simple change to the algorithm makes its worst case **Θ (nlogn)?**

(7) Radix sort the following list of integers in base 10 :

Original list	First sort	Second sort	Third sort
583			
625			
682			
243			
745			
522			

(8) Consider the problem of sorting, in worst-case linear time, an array A of 10,000 9-digit social security numbers in increasing order. For each of the sorting algorithms below, indicate whether or not the algorithm will achieve worst-case, linear-time performance, and briefly explain why or why not.

a. Counting Sort

b. Radix sort

c. Bucket sort

d. Merge sort

(9) State weather the following statements are True or false:

a) If you use chaining to resolve collisions, you never have to resize the hash table, as long as you are willing to take a hit in performance.

b) A major advantage of resolving collisions via chaining, instead of open addressing, is that there is no way to support element deletions under open addressing without rehashing the entire table every time a single element is deleted.

c) Consider a partially filled hash table T that uses double hashing to implement open addressing. Suppose that the following two operations are performed, in order:

(Step 1) A key k is searched for in T, and the search is unsuccessful.

(Step 2) The same key k is then inserted into T.

d) Then, true or false: The number of key comparisons performed during step 2 is greater than the number of key comparisons performed during step 1.

e) When you double the size of a hash table, you can keep using the same hash function.

(10) Suppose that the universe U of possible keys is U {1…….n^{2} - 1}. For a hash table of size n, what is the greatest number of distinct keys the table can hold with each of these collision resolution strategies?

I. Chaining

II. Linear probing

III. Quadratic probing

(11) What is clustering?

(12) Demonstrate the insertion of the keys 4,27,18,14,19,32,11,16 into a hash table with collisions resolved by linear probing. Assume that the table has 9 slots and that the hash function is h(k) = k mod 9. Draw the state of the hash table after all insertions.