

CS140b Spring 96 – Quiz 4
Prof. Frank Vahid

Name: _____ Student number: _____

1. (2 pt.) Finish the Quicksort function shown below:

```
void QuickSort(Element *list, const int left, const int right)
{
    if (left < right)
    {
        int i=left, j=right+1, pivot=list[left].getKey();

        do {
            do i++; while (list[i].getKey() < pivot);
            do j--; while (list[j].getKey() > pivot);
            if (i<j) InterChange(list,i,j);
        } while (i<j);

        InterChange(list, left, j);
    }
}
```

2. (1 pt.) Concisely define a “stable” sorting algorithm.
3. (9 pt.) Give the time complexities for the following:
- (a) Merging two sorted lists:
 - (b) Quicksort (average and worst case):
 - (c) Mergesort (average and worst case):
 - (d) Heapsort (average and worst case):
 - (e) Heapsort using a binomial heap (briefly justify your answer):
 - (f) Cheapsort, where a *cheap* is a heap that you’ve ingeniously developed with $O(1)$ insert and delete:
 - (g) Radix sort (worst case), where the number of digits is X , and the number of possible values for each digit is Y :
 - (h) Binomial heap insertion (amortized):
 - (i) Binomial heap deletion (amortized):

4. (3 pt.) Trace LSD radix sort assuming each character may have value a, b, or c. Remember, LSD starts with the *rightmost* character. SHOW THE BINS at each stage, even if empty!

aaa cab baa caa bab aab

5. (2 pt.) Given identifiers exactly 3 characters in length where each character can be a lower case 'a' through 'z', and given a hash table with 100 buckets using chaining, compute the following:
- (a) Identifier density:
 - (b) α (loading density) after 50 identifiers are inserted:
6. (4 pt.) Complete the following table. If worst case differs from average case, list both. Justifying your answer will help with partial credit. (1 point for each correct answer, -1 for incorrect or blank, max of 4, min of 0).

	Sorted array	Hash table	Min heap
Search			
Insert	O(n) (search+shift)		
Find min, don't delete			

7. (2 pt.) Given a hash table of size 7 using linear probing and a hash function of $x \bmod 7$, show the hash table contents after inserting 1 2 8 9 (in the given order).