CIS507: Design & Analysis of Algorithms
Quiz 3, Spring 2012

Duration: 20 minutes
Total weight: 5%

Student Name: –

Student ID: –

Problem	Points Obtained	Points Possible
1		3
2		2
Total		5

1 True or False (3 points)

1. **(1 point)** Instead of using counting sort to sort digits in the radix sort algorithm, we can use any valid sorting algorithm and radix sort will still sort correctly.

2. **(1 point)** Suppose we use simple uniform hashing, and resolve collisions by chaining. If we have n keys and m slots, then the expected time to search for a record with a given key is $\Theta(1 + \frac{n}{m})$.

3. **(1 point)** Counting sort is a comparison-based sorting algorithm.

2 Sorting (2 points)

Suppose we have an array of n integers in the range $0, 1, \ldots, n^5 - 1$. Assume we use RADIX-SORT with COUNTING-SORT as the auxiliary sorting algorithm (for sorting by each digit).

1. **(0.5 point)** If we use base 10, what is the maximum number of digits in each integer?
2. **(0.5 point)** If we use base n, what is the maximum number of digits in each integer?
3. **(0.5 point)** If we use base 10, what is the running time of RADIX-SORT?
4. **(0.5 point)** If we use base n, what is the running time of RADIX-SORT?

Hints:

- COUNTING-SORT takes $\Theta(n + k)$ for an array of n integers in the range $0, \ldots, k$.
- To represent integer x in base b requires $\log_b x$ digits.