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 COSC 999
 1/31/2018

Assignment 1

Problem 1: Here is the solution for problem 1.

The digits of a number are how many bits are required to display that number in a base. Assume we have a base b , (starting from the right) the first digit is for b^1 , the 2nd is for b^2 , the 3rd is for b^3 . For this algorithm, since our bound is n^2 , we want to have a base that will only require 2 digits.

We can solve $\log_b(12^2) = 2$ to find that our base b should be 12.

Since we have 12 numbers to sort, the log base is set to 12. In this case, if we have $\log_{12}12^2$, then our answer is 2.

Let us convert all the numbers from base 10 to base 12 and then perform radix sort.

Base 10		Base 12		Sort First Digit		Sort Second Digit
45		39		$b0$		03
98		82		60		07
3		03		82		24
82		$6a$		03		39
132		$b0$		24		39
71	\rightarrow	$5b$	\rightarrow	77	\rightarrow	$5b$
72		60		07		60
143		bb		39		$6a$
91		77		39		77
28		24		$6a$		82
7		07		$5b$		$b0$
45		39		bb		bb

Radix Sort takes $O(n)$ time, but we must do radix sort $O(\log_b n^2)$ times as defined by the number of digits. Since both our b and n are 12, this becomes $O(2)$ time (number of digits), so our overall time complexity is $O(n)$.

Problem 2: Here is the solution for Programming Task 1