//Class: CSC 310

//Due Date: 10/26/18

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//Asssignment: Project 1 - Radix Sorting

package csc310project1radix;

import java.util.Scanner;

import java.util.\*;

public class CSC310Project1Radix {

//Get the Maximum Number within the queue

static int maxNum( int q[] ){

int len = q.length;

//This for loop will go throughout the queue and record the highest

// number and record it as the maxN

//The initial maxN will be the first number. If the code finds a higher

// number, the maxN will then be replaced by that higher number.

int maxN = q[0];

for ( int i = 1; i < len; i++ )

if (q[i] > maxN)

maxN = q[i];

return maxN;

}

//CountingSort

static void counter( int q[], int exp ){

int len = q.length;

//Create two empty queues, one is the output which will be the final

// queue that is sent out to the coderunner.

//The bucket will sort the current digit and place them accordingly into

// buckets whos items share the same digit.

//The bucket queue should be filled with zeros at first.

int output[] = new int[len];

int bucket[] = new int[10];

for ( int i = 0; i < 10; i++ ) {

bucket[i]=0;

}

//create i outside the for loop so it can be used later

int i;

//Count intances in the buckets

for ( i = 0; i < len; i++ ){

bucket[(q[i]/exp)%10 ]++;

}

//bucket[i] now contains the index in Output of the current digit.

for ( i = 1; i < 10; i++ ){

bucket[i] += bucket[i - 1];

}

//fill the output with the digits that have been sorted in the bucket

for ( i = len - 1; i >= 0; i-- ){

int p = (q[i]/exp)%10;

output[ bucket[p] - 1] = q[i];

bucket[ p ]--;

}

//return the queue that was passedd into the method by replacing it

// with the output queue.

for ( i = 0; i < len; i++ ){

q[i] = output[i];

}

}

// Radix Sort

static void radixsort( int q[] ){

int len = q.length;

//The max Number will give us the amount of digits to be used later

int maxN = maxNum(q);

//Counter will sort all digits. indx is the index of the digit within

// the number

for ( int indx = 1; maxN/indx > 0; indx \*= 10 )

counter( q, indx );

}

//print the array passed into the method

static void print( int q[] ){

System.out.println("The sorted list is: ");

for ( int i = 0; i < q.length; i++ )

System.out.print( q[i] + " " );

}

//main function

public static void main (String[] args){

Scanner in = new Scanner(System.in);

System.out.println("This program will apply a Radix sort to a list of numbers ");

System.out.print("Please enter how many numbers you would like to sort: ");

int size = in.nextInt();

int[] q = new int[size];

for (int i = 0; i < size; i++) {

System.out.print("Enter a number: ");

q[i]= in.nextInt();

}

System.out.println("");

radixsort(q);

print(q);

System.out.println("");

}

}