Contest Problems

High School Coding Contest

Saturday, April 10/2021, @9:00-11:00 AM ***Contest Contact:*** **mmalita@smith.edu**

I code therefore I am!

Problem 1. Smaller and Greater

Ask the user for n (ask for n >= 0) distinct integers separated by spaces. (You do not need to check that the numbers are distinct.) Divide the list into 2 equal parts where the original ordering is preserved. The elements in the first list must be smaller than all of the elements in the second list. If there are an odd number of elements, divide the list into 3 parts where the middle part has exactly 1 element. Formatting: Separate elements with a single space and sublists with two hyphens (--). Python Tip: If the number of numbers doesn't equal n, reprompt the user.

Example 1:

n? 4
Enter Numbers? 4 5 1 9
Result: 4 1 -- 5 9

Example 2:

n? 1
Enter Numbers? 0
Result: -- 0 --

Example 3:

n? 7
Enter Numbers? 8 3 9 2 5 1 7
Result: 3 2 1 -- 5 -- 8 9 7

Problem 2. Check Triangle

Ask the user for three points with coordinates between 0 and 200. If the entered points are not in the range, ask again. Check if the three points can form a triangle and print the result (Yes or No). Follow the formatting below.

Example 1:

Point 1? 300 5
Point 1? 0 1
Point 2? 0 3
Point 3? 0 6
Result: No

Example 2:

Point 1? 0 1
Point 2? 0 3
Point 3? 5 6
Result: Yes

Problem 3. Find Diagonals

The program generates a random table (matrix) size n x m (ask for n rows and m columns) filled with characters (+, -). Find the largest square subtable(s) from this table with the property that all elements from the first diagonal are the same. Display the indices of the top-left corner and size of the solution matrices. Note that a subtable keeps inside neighbors the same and is made from only cuts.

Original Table	Subtable	Not a Subtable
`a b c d`	`a b`	`a c`
`e f g h`	`e f`	`e g`

Example 1:

```
Enter n? 4
Enter m? 6
Original Matrix: 4 x 6
- - - - + -
- - - - - -
- + - + - -
+ + - - - +
Result: 4 x 4
(0,0)
- - - -
- - - -
- + - +
+ + - -
```

Example 2:

```
Enter n? 3
Enter m? 3
Original Matrix: 3 x 3
- - -
- + +
+ - +
Result: 2 x 2
(1,0)
- +
+ -
(1,1)
+ +
- +
```

Example 3:

```
Enter n? 3
Enter m? 3
Original Matrix: 3 x 3
- + +
- - +
+ - -
Result: 3 x 3
(0,0)
- + +
- - +
+ - -
```

Example 4:

```
Enter n? 5
Enter m? 3
Original Matrix: 5 x 3
- - -
- + -
+ + -
+ + +
+ + +
Result: 3 x 3
(2,0)
+ + -
+ + +
+ + +
```

Problem 4. Same Digits

Given a positive integer, find the sum of the digits and the smallest integer and greatest integer that can be formed from the same digits. Keep the number of occurrences of each digit the same.

Example 1:

Input? 253
Sum: 10
Smallest: 235
Greatest: 532

Example 2:

Input? 2373
Sum: 15
Smallest: 2337
Greatest: 7332

Example 3:

Input? 2303
Sum: 8
Smallest: 2033
Greatest: 3320

Problem 5. Left to Right

Create an n x n matrix (ask for n >= 2) with randomly generated 1s and 0s. (You don't need to check the input data). Find a path from the left border to the right border by jumping from 1 to 1 (only if they are neighbors). A neighbor is any cell that is from the next column in the same row, or one above, or one below. The neighbors of the 1 in the 4 by 4 matrix below are bolded.

0 0 0 0
0 0 **0** 0
0 1 **0** 0
0 0 **0** 0

Your program should output a matrix that displays a single path as 1s and the rest of that matrix as 0s. If there is no path, the output matrix is just zeros.

Example 1:

Enter n? 3
1 0 1
0 1 1
1 0 0
Result:
1 0 **1**
0 **1** 0
0 0 0

Example 2:

Enter n? 4
1 0 1 0
0 1 1 1
1 0 0 0
0 0 0 0

Result:
1 0 **1** 0
0 **1** 0 **1**
0 0 0 0
0 0 0 0

Example 3:

Enter n? 2
0 0
1 1
Result:
0 0
1 **1**

Example 4:

Enter n? 4
1 0 1 1
0 0 0 0
1 1 0 0
1 1 0 0
Result:
0 0 0 0
0 0 0 0
0 0 0 0
0 0 0 0

Example 5:

```
Enter n? 5
0 0 1 1 0
1 0 0 1 1
0 0 1 1 0
1 1 1 0 0
1 0 0 0 0
Result:
0 0 0 0 0
0 0 0 1 1
0 0 1 0 0
1 1 0 0 0
0 0 0 0 0
```