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Lab Worksheet 4 (10/03/2025) CELEN087

Instruction:

You are suggested to complete **this worksheet** and **Homework Exercise 4** by end of this week.

After writing your function, you should test it with different input values to ensure it is correct.

1. Write a function **min3.m** that takes three numbers a, b and c and returns the smallest number.
   How many test cases are needed to check your function thoroughly?

2. Write a function **SumDiff.m** that takes two numbers as its inputs and returns two numbers that are the sum and difference of the input values respectively.

3. Create a MATLAB function **quadRoot.m** for finding two roots of the quadratic equation $ax^2 + bx + c = 0$. It should takes three input arguments a, b, c and return two complex roots x_1, x_2. For example,

   calling `[x1,x2]=quadRoot(1,-2,-3)`, we have

   `x1 = 3,  x2 = -1`

   calling `[x1,x2]=quadRoot(1,-2,1)`, we have

   `x1 = 1,  x2 = 1`

   calling `[x1,x2]=quadRoot(1,-2,3)`, we have

   `x1 = 1.0000 + 1.4142i,  x2 = 1.0000 - 1.4142i`

4. Write a function **sumList.m** that takes a list of numbers (a nonempty vector) and returns the sum of all numbers. For example,

   calling `sumList([2,3,1,7])` should return 13.

5. Write a function **minList.m** that takes a non-empty array and returns the smallest number in the array.
   Do not use the built-in function `min()`.

6. Write a function **newList.m** that takes a non-empty array u as its input, and returns an array v in which all elements are obtained by substructing the smallest number from u. For example,

   calling `newList([2,3,1,7])` should return `[1,2,0,6]`.

7. Write a function **listMaxMin.m** that takes a nonempty array and returns the maximum and minimum values in it.
   This function has two output values, so you should call it in a similar way to Question 2 or 3.

8. (a) Write a recursive function **myGCD.m** that find the Greatest Common Divisor of two positive integer numbers. (*Sem-1, CELEN086 Lecture 3*)

   Note: MATLAB also has built-in function gcd() for it. You can compare your computed values to it to check the correctness.

   (b) Similar to the lab note examples, we can also make use of iteration technique instead of recursion to design this program. Think about how to use While Loop for writing this function.

   You can first design your own algorithm or refer to one algorithm via this link.

9. In statistics, the mean value μ of a given set of data $x_1, x_2, \ldots, x_n$ is computed by:

$$\mu = \frac{x_1 + x_2 + \cdots + x_n}{n} = \frac{1}{n}\sum_{i=1}^{n} x_i.$$

   The variance is then computed by:

$$var = \frac{(x_1 - \mu)^2 + (x_2 - \mu)^2 + \cdots + (x_n - \mu)^2}{n} = \frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2.$$

   (a) Write a function **myMean.m** that takes a set of data in an array and returns the mean value.

   (b) Write a function **myVar.m** that takes an array and returns the variance.

   You can call the function `myMean()` in part (a).

   (c) Write a function **myStat.m** that takes an array and returns two output values that are the mean and variance repectively.

   (d) Write a script **test.m** to test your function in part(c) using with the following data sets.

   (i) `[1, 2, 3, 4, 5]`.

   (ii) 10 integers that are randomly generated between 5 and 25.

10. Write a function **circle.m** that takes three input arguments a, b and r. It should plot the graph of the circle centered at (a, b) with radius r using the parametric equation

$$x = a + r\cos t, \quad y = b + r\sin t.$$

    Note: This function has no numerical output values; instead it will generate a figure. You can check the sample code circlePlot.m on Moodle.

11. Write a function **sumDigit.m** that takes a positive integer and returns the sum of all its digits. For example,

    `sumDigit(2025) = 9`,

    `sumDigit(9) = 9`.

12. Write a function **countDigit.m** that takes a positive integer and returns how many digits it has. For example,

    `countDigit(2025) = 4`,

    `countDigit(9) = 1`.