

EE2021 Computer Tools for Electrical Engineering

Midterm Exam

Due: December 8, 2020 at 09:00

Please compress the m files (numberOfCoins.m, findRegularNumbers.m, rightTriangleEdges.m and continuousInterval.m) to “name_surname_studentno.zip”, and upload it to ues.marmara.edu.tr until due date and time.

1. (25 pts) Suppose that you are working as a cashier in a supermarket and there are no banknotes left in the cash box. Therefore, for each transaction, you must pay the remainder of the money by coins.

Write a function `numberOfCoins(totalAmount, paidAmount)` that returns the minimum number of coins required to pay the remainder of the money to the customer. If the customer pays less than the total amount of transaction, the function should give the following error message:

The customer paid less than the total amount of the transaction

and abort. Note that you have sufficient amounts of 1kr, 5kr, 10kr, 25kr, 50kr, 1TL coins in the cash box.

The following table shows a possible list of outputs of the function `numberOfCoins`.

Function call	Output
<code>numberOfCoins(99.12, 100)</code>	6
<code>numberOfCoins(17.95, 20)</code>	3
<code>numberOfCoins(10, 10)</code>	0
<code>numberOfCoins(3.99, 3.5)</code>	Error

Table 1: A list of possible outputs of the function `numberOfCoins`

For instance, if the total transaction is 99.12TL and the customer gives you 100TL, you must pay 1x50kr, 1x25kr, 1x10 kr and 3x1kr coins to the customer (6 coins in total).

2. (25 pts) In mathematics, the definition of a regular number is given as follows

”A regular number is an integer of the form $2^i 3^j 5^k$, for nonnegative integers i, j , and k .”

For instance, the first 10 regular numbers are: 1, 2, 3, 4, 5, 6, 8, 9, 10, 12. Write a function `findRegularNumbers(x)` that returns the array of first x regular numbers where x is a positive integer.

3. (25 pts) Write a function `rightTriangleEdges(listOfIntegers)` that returns a triplet `[x y z]` from the list of integers `listOfIntegers` where `x`, `y` and `z` satisfy $x^2 + y^2 = z^2$. If no such triplet exists, the function should return an empty array.

The following table shows a possible list of outputs of the function `rightTriangleEdges`.

Function call	Output
<code>rightTriangleEdges([1 2 3 4 5 6 7 8])</code>	<code>[3 4 5]</code>
<code>rightTriangleEdges([1 4 5 6 13 8 12])</code>	<code>[5 12 13]</code>
<code>rightTriangleEdges(1:4)</code>	<code>[]</code>

Table 2: A list of possible outputs of the function `rightTriangleEdges`

4. (25 pts) Suppose that there is a door whose password may change at the beginning of each hour. You have an electronic key that can store up to 2 passwords. Given the list of door passwords for consecutive hours, you want to determine the passwords for your electronic key for which they match with the passwords of the door for the longest continuous interval.

For this purpose, write a function `continuousInterval(doorPasswords)` that returns the optimal choice of passwords for the electronic key and the duration of the longest continuous interval (in hours) for the optimal choice where `doorPasswords` is the list of door passwords for consecutive hours.

The following table shows a possible list of outputs of the function `continuousInterval`.

Function call	optimalPasswords	duration
<code>continuousInterval([3 5 7 3 2 2 1 2 5 3 2 1 2 3])</code>	<code>[1 2]</code>	4
<code>continuousInterval([2 1 2 3 3 1 3 1 5])</code>	<code>[1 3]</code>	5
<code>continuousInterval([1 2 3 2 4 3])</code>	<code>[2 3]</code>	3

Table 3: A list of possible outputs of the function `continuousInterval`

Good luck!