CENG113 Problem Sets 9 - Recursion

1. Write a recursive method for each of the following problems.

a) Find the product of all integers from X to Y, inclusively.

b) Find the sum of a specific row of a given matrix.

c) Find the position of the minimum number in a one-dimensional array.

d) Find the product of only the elements in even numbered positions of a one-dimensional array.

e) Find how many multiples of N exist between X and Y. For instance, if X is 5, Y = 10, N = 2, the result should be 3, because there are 3 multiples of 2 between 5 and 10: 6, 8, and 10.

f) Find the sum of the multiples of N that exist between X and Y. For instance, if X is 5, Y = 10, N = 2, the result should be 24, because the multiples of 2 between 5 and 10 are 6, 8, and 10.

g) Given a positive integer, display its digits in the reverse order. For instance, if the given integer is 1234, the output should be 4321.

h) Given a string, display its characters in the reverse order. For instance, if the given string is "abcd", the output should be "dcba".

i) Find the number of occurrences of a certain character within a string. For instance, if the string is "daddy", and the character is 'd', the result should be 3.

j) Find the position of the last non-blank character of a string. For instance, if the string is "ALI AKIN ", the result should be 7.

k) Find the position of the last occurrence of a double number in a one-dimensional array, using linear search algorithm, recursively.

l) Find the position of the last occurrence of a double number in an ascendingly sorted one-dimensional array, using linear search algorithm, recursively.

m) Sort a list of double numbers (stored in a one-dimensional array), using selection sort algorithm, recursively.

n) Sort a list of double numbers (stored in a one-dimensional array), using bubble sort algorithm, recursively.

o) Find the greatest common divisor of two positive integers. The greatest common divisor of two positive integers M and N, GCD (M, N), is the largest positive integer that divides both M and N. Thus, for instance, GCD (100, 5) == 5, GCD (100, 33) = 1, GCD (102, 30) = 6. This can be found by using the division algorithm, as follows:

```
102 = 30 * 3 + 12
 30 = 12 * 2 + 6
 12 = 6 * 2 + 0
```

Notice that:

```
GCD (102, 30) = GCD (30, 12)
              = GCD (12, 6)
              = 6
```

In each case, the remainder is used in the next step. The process terminates when a remainder of 0 is obtained.

2. Write recursive methods that display each of the following outputs when they are called with the string on the first line.

a)
```
THE EXAM
HE  EXAM
E  EXAM
  EXAM
EXAM
XAM
AM
M
```

b)
```
THE  EXAM IS VERY EASY
HE  EXAM IS VERY EAS
E  EXAM IS VERY EA
  EXAM IS VERY E
EXAM IS VERY
XAM IS VERY
AM IS VER
M IS VE
  IS V
IS
S
```