Euclid's algorithm

Software Documentation

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Introduction

This software documentation includes: description of the application's operation, what is needed for use, algorithms used, interface description and source code description. The application is used to calculate the greatest common divisor according to the Euclid's algorithm.

Describing of the application's operation

After running the script, the application prompts you to enter the values of a and b. The algorithm then calculates the value of the greatest common divisor.

What is needed for use?

The application does not require installation. It only needs the Windows operating system.

Algorithms used

Two algorithms were used in writing the script: the subtraction version and the modulo function.

The simplest version of the algorithm begins with selecting two natural numbers for which the greatest common divisor should be found. Then we make a new pair of these two numbers: the first number is the lesser number, and the second is the difference between the greater number and the lesser number. This process is repeated until both numbers are equal - the value of these numbers is the greatest common divisor of all pairs of numbers previously determined. The disadvantage of this version of the algorithm is the large number of subtractions that must be performed when the difference between the numbers in the pair is significant.

The operation of subtracting a smaller number from a larger number can be replaced by determining the remainder of the division. In this version, the new pair of numbers consists of the smaller number and the remainder dividing the larger by the smaller. The algorithm ends when one of the numbers is zero - the other is then the greatest common divisor.

Example - version with subtraction

Suppose we want to find the greatest common divisor of 1989 and 867. If we subtract a smaller number from the greater number, the value of the greatest common divisor will not change. Since 1989 - 867 = 1122, the new pair of numbers looks like this:

1122, 867

Again, we subtract the smaller number from the larger 1122 - 867 = 255, thus making another pair:

255, 867

867 is no longer a smaller number. Using the same method, we reduce the value of the larger number again by the smaller number: 867 - 255 = 612, the new pair of numbers is:

255, 612

The first number, 255, is still smaller, so again we subtract 255 from the larger number: 612 - 255 = 357, so the next pair of numbers is:

255, 357

357 - 255 = 102, the next pair is:

255, 102

Now we can see that 255 is a larger number, so we subtract 102 from it, which gives us a pair:

153, 102

Subtracting 102 from 153 gives us another pair:

51, 102.

Now we subtract 51 from 102, which gives us:

51, 51

Since the two numbers are equal, the next subtraction will give us zero. This means that the greatest common divisor of 1989 and 867 is 51.

Algorithm using modulo function

The algorithm using the modulo function is the second equivalent implementation of the Euclidean algorithm. The following is a version of the GCD calculation of a and b using the division remainder (modulo):

compute c as the remainder of division a by b

replace a with b, then b with c

if the value of b is 0, then a is the gcd you are looking for, otherwise go to step 1.[1]

```
NWD subroutine (a, b)
     until b ≠ 0
         c: = remainder of division a by b
         a: = b
         b: = c
     return a
```

Listing 1: Pseudocode [1]

Source code description

The project was made in the Python programming language, in the PyScripter programming environment. All work was done on the Windows 10 operating system. The application's source code looks like this.

```
a=int(input("Enter a: "))
b=int(input("Enter b: "))
a2=a
b2=b

#Algorithm version
while a!=b:
    if a>b:
        a-=b
    elif a<b:
```

```
        b-=a
print("GCD="+str(a))

'''Modulo version'''
while b2!=0:
    c=a2%b2
    a2=b2
    b2=c
print("GCD="+str(a2))
```

Listing 2: Source code [own study]

List of listings

Bibliography

[1] https://pl.wikipedia.org/wiki/Algorytm_Euklidesa