

Lab 5 Flow of Control (II): Looping Statements

Please test the correctness of your programs on **PASS**.

Q-3. [will be marked]

A Pythagorean triple consists of three **positive integers** a , b , and c , such that $a^2 + b^2 = c^2$. Such a triple is commonly written as (a, b, c) , and a well-known example is $(3, 4, 5)$. A triangle whose sides form a Pythagorean triple is called a Pythagorean triangle, and is necessarily a right triangle. In this exercise, let's try to find the total number of possible Pythagorean triples, given a specified searching range (meaning the shortest triangle edge and the longest triangle edge are both within the range). For instance, the only solution to the searching range $[3, 5]$ (both 3 and 5 are included) is $(3, 4, 5)$. Hence, **we say that the number of all Pythagorean triplets between 3 (lower bound) and 5 (higher bound) is 1.**

As a straightforward solution, let's first check all possible integers in the given range. We can use a triple-nested for loop that tries all possibilities. This is an example of "brute force computing". You will learn in more advanced computer science courses that there are many interesting problems for which there is no known algorithmic approach other than using sheer brute force.

Expected Output:

Example 1
Please input the maximal length allowed for the edge: <u>10</u> Please input the minimal length allowed for the edge: <u>1</u> The number of all Pythagorean triplets between 1 and 10 is 2.
Example 2
Please input the maximal length allowed for the edge: <u>100</u> Please input the minimal length allowed for the edge: <u>10</u> The number of all Pythagorean triplets between 10 and 100 is 45.
Example 3
Please input the maximal length allowed for the edge: <u>1</u> Please input the minimal length allowed for the edge: <u>10</u> Invalid inputs!
Example 4
Please input the maximal length allowed for the edge: <u>0</u> Please input the minimal length allowed for the edge: <u>-1</u> Invalid inputs!

Hint 1: To avoid producing duplicate Pythagorean triples, start the second for loop at $b = a$, and the third for loop at $c = b$. This way, when a Pythagorean triple is found, a will be the shortest side of the triangle and c will be the longest side.

Hint 2: Make sure the maximal length is larger than minimal length and both are positive integers. Otherwise, output "Invalid inputs!".

Hint 3: This program can take a significant amount of time to run, for some large ranges. If you have a CPU monitor available on your system, it is worth taking a look at it when this program executes.

Hint 4: Do not be concerned that you are trying values that do not seem to make sense, such as a $(1, 1, 500)$ triangle. Remember that brute-force techniques try all possible values.