Data Structure and Algorithms

Problem Set 1: Basic problem solving

Date of issue: **Due Date:**

Problem 1) Pythagorean triple: Three numbers form a Pythagorean triple if the sum of squares of two numbers is equal to the square of the third.

For example, 3, 5 and 4 form a Pythagorean triple, since 3*3 + 4*4 = 25 = 5*5

You are given three integers, a, b, and c. They need not be given in increasing order. If they form a Pythagorean triple, then print "yes", otherwise, print "no". Please note that the output message is in small letters.

	Input	**Output**
Test Case 1	3 5 4	yes
Test Case 2	5 8 2	no

Problem 2) Sum of powers of number: In this program, you are given an input N, which is a positive integer less than or equal to 40. Write a program to find the sums of fourth powers of the first N numbers.

Ex Input: n=2 (1^4+ 2^4)

Output: 17

	Input	**Output**
Test Case 1	2	17
Test Case 2	1	1

Problem 3) Triangular matrix: In this assignment, you will be given an NxN matrix. You have to determine whether the matrix is a triangular matrix.

The diagonal of the matrix M of size NxN is the set of entries M(0,0), M(1,1), M(2,2), ..., M(N,N).

A matrix is *upper triangular* if every entry *below* the diagonal is 0. For example,
1 1 1
0 0 1
0 0 2
is an upper triangular matrix. (The diagonal itself, and the entries above and below the diagonals can be zeroes or non-zero integers.)

A matrix is *lower triangular* if every entry above the diagonal is 0. For example,
2 0 0
3 1 0
4 2 2
is a lower triangular matrix.

	Input	**Output**
Test Case 1	2 1 1 0 1	Yes
Test Case 2	3 1 0 0 0 1 0 1 1 2	Yes
Test Case 3	3 1 0 1 0 1 0 1 1 2	No

Problem 4) Find the second largest: You are given a sequence of integers as input, terminated by a -1. (That is, the input integers may be positive, negative or 0. A -1 in the input signals the end of the input.)

-1 is not considered as part of the input.

Find the second largest number in the input. You may **not** use arrays.

	Input	**Output**
Test Case 1	`-840 -288 -261 -337 -335 488 -1`	`-261`
Test Case 2	`-840 -335 -1`	`-840`

Problem 5) Sum of adjacent pairs: You are given a sequence of numbers, ending with a -1. You can assume that are at least two numbers before the ending -1.

Let us call the sequence x_0 x_1 ... x_n -1.

You have to output the sequence of sums of adjacent pairs of numbers, as follows:

x_0+x_1 x_1+x_2 ... $x_{n-1}+x_n$

Note that the sums are separated by spaces. Kindly do not use arrays in the code.

	Input	**Output**
Test Case 1	`4 5 6 7 -1`	`9 11 13`
Test Case 2	`3 4 5 -1`	`7 9`
Test Case 3	`1 2 -1`	`3`

Problem 6) Inverted right angle: Write a program to do the following:-

a) Take height h as the input
b) Based on the height, print h lines in output such that they form a pattern in the shape of an "inverted" right angled triangle
c) Each line should form an Arithmetic Progression with the starting element = row_number and common difference = 1. Take modulo 10 for numbers greater than 9

	Input	**Output**
Test Case 1	5	12345 2345 345 45 5
Test Case 2	14	12345678901234 2345678901234 345678901234 45678901234 5678901234 678901234 78901234 8901234 901234 01234 1234 234 34 4