



# Computer Olympiad

South African Computer Olympiad: a project of the Computer Society of South Africa.

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## SECOND ROUND 2009

This paper is for ALL candidates  
Each correct answer earns 5 marks

### Q 1. Calculator Button

*Authors: Michiel Baird and  
Robert Ketteringham  
Proposed by: Max Rabkin*

#### Introduction

Your calculator has a mysteriously unmarked button, that you suspect is either a plus (+) or a times (x). If you press the button between two numbers, and examine the calculator's output, you could find out what the button could be.

#### Task

Write a program that determines which button it can be: a plus (+) or times (x) button. Your program should read in three numbers: the first two being the numbers entered into the calculator along with the mysterious button and the last number, being the calculator's answer.

If the button can be either a plus *or* times button, output "Plus or Times". If the button can *only* be a plus or *only* be a times button, output which one it can be ("Plus only" or "Times only"). If it can be neither plus *nor* times, output "Neither Plus nor Times". Lastly, output both the plus and times equations.

#### Sample Run

##### Input

First number: 4  
Second number: 2  
Answer: 6

##### Output

Plus only  
4+2=6  
4x2=8

### Test Your Program With

(i)	5	6	11	(5)
(ii)	2	4	8	(5)
(iii)	2	2	4	(5)
(iv)	7	2	4	(5)

### Q 2. Bar Graph

*Authors: Donald Cook and Peter Waker*

#### Introduction

A bar graph represents numbers by the length of either a vertical or horizontal bar."

#### Task

Write a program to create a bar graph that will represent any number as a series of horizontal bars, representing the digits of the number.

Your program must first print the digit and then the bar, using asterisks (\*), as in the example given below. Only positive integers will be given, and no number will have more than 9 digits.

#### Sample Run

##### Input

Enter the number: 5103

##### Output

```
5 *****
1 *
0
3 ***
```

### Test Your Program With

(i)	4	(5)
(ii)	429	(5)
(iii)	4870864	(5)
(iv)	123456789	(5)

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## Q 3. Arithmetic Progression

Author: Julian Kenwood  
Proposed by: Bruce Merry

### Introduction

An arithmetic progression is a sequence where the difference between any two consecutive numbers is always the same. This difference is known as the common difference. In an increasing arithmetic progression this common difference is greater than zero.

### Task

Input N distinct integers. Your task is to find the longest increasing arithmetic progression in these numbers. Note that there could be multiple longest increasing arithmetic progressions. First output the length of the longest arithmetic progression. Then output the number of increasing arithmetic progressions with this length. Finally output the first term and the common difference of the longest increasing arithmetic progression with the smallest first term. If more than one of them has that first term, output the smallest common difference.

## Sample Run

### Input

```
Enter N: 5
Enter a number: 1
Enter a number: 5
Enter a number: 9
Enter a number: 11
Enter a number: 3
```

### Output

```
Arithmetic Progression Length = 3
Number of Arithmetic Progressions = 2
Arithmetic Progression First Term = 1
Arithmetic Progression Common
Difference = 2
```

### Explanation

There are two increasing arithmetic progressions of length 3 in the set {1, 5, 9, 11, 3}:

- 1 3 5, with first term 1 and a common difference of 2
- 1 5 9, with first term 1 and a common difference of 4

### Test Your Program With

- (i) N = 5  
1 5 3 9 7 (5)
- (ii) N=10  
103 304 2004 19 35 85 13 78 10 77 (5)
- (iii) N=10  
1 4 9 16 25 36 49 64 81 100 (5)
- (iv) N=15  
1 15 4 7 11 10 8 9 13 16 19 23 22 26 29 (5)

