



# Computer Programming Olympiad

A project of the Institute of IT Professionals South Africa

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## Programming Olympiad 2014: Round 1

Not to be used before 1 August 2014

- This paper is for ALL candidates.
- Each correct answer earns 5 marks.
- You have 2 hours to attempt as many questions as possible.
- Programs that produce 3 correct answers can earn additional marks for readability, conciseness, and for appropriate comments and variable names.
- Indicate the question, your name, surname and the language and version used at the start of every program e.g. "Q3 Sam King, Python 2.7"
- Save your program as Qn Name Surname e.g. Q3 Sam King
- The national judges may use test cases not listed here.
- **DO NOT MODIFY ANY FILES AFTER THE END OF THE CONTEST AS THIS WILL LEAD TO DISQUALIFICATION**

### 1. RECTANGLES

#### Task:

Write a program that will print a rectangle made up of Xs (X, X, X, etc) as in the example below.

The number of rows (R) and the number of columns (C) are given. R and C will be positive whole numbers less than 100.

#### Example:

Input: R = 3  
C = 5

Output: XXXXX  
XXXXX  
XXXXX

#### Test your program with

- (a) R = 4 C = 4
- (b) R = 11 C = 2
- (c) R = 4 C = 12

[ICPSC]

### 2. FIBONACCI

In the Fibonacci sequence every number, from the third number onwards is the sum of the previous two numbers. For example: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, etc

#### Task:

Write a program that will print out a Fibonacci sequence of length L that starts with the numbers F and S (First and Second). The numbers must be separated by commas or spaces.

F and S will be whole numbers between -100 and 100. L will be a positive whole number less than 100.

#### Example:

Input: F = 2  
S = 3  
L = 8

Output: 2, 3, 5, 8, 13, 21, 34, 55

#### Test your program with

- (a) F = 2 S = 2 L = 10
- (b) F = 4 S = 6 L = 8
- (c) F = -2 S = 3 L = 12

[Donald Cook]

### 3. ORDERED SQUARES

A number is an ordered number when its digits are in an increasing sequence. For example 136 is an ordered number but 163 is not; 225 is an ordered number, but 252 is not. A single digit number is always ordered.

A square is a number obtained by multiplying a positive whole number by itself. 16 is a square (4 x 4).



**Task:**

Write a program that will print out all the ordered squares up to and including a given value (V). Separate the ordered squares by commas or spaces. V will be a positive whole number less than 100,000

**Example:**

Input: V = 30  
Output: 1, 4, 9, 16, 25

**Test your program with**

- (a) V = 100
  - (b) V = 1 000
  - (c) V = 2 000
- [ICPSC]

### 4. WORD SQUARE

**Task:**

Write a program that will find given words in the 8 by 8 word square below. You may assume that the words appear in rows and read forward (L to R) or backwards (R to L). [Hint: As you use the same word square all the time you can save time by hardcoding it into your program.]

T	H	E	Q	T	T	E	P
L	R	E	K	A	W	R	E
T	S	E	T	N	O	C	I
X	Y	C	O	L	T	Z	J
R	C	H	I	L	E	S	Q
U	M	N	X	B	E	S	T
Y	X	K	O	O	C	Q	F
G	H	I	K	C	O	R	B

Your program should print out the word and indicate the row and column where the word begins and in which direction it proceeds (forwards or backwards).

**Example:**

Input: COLT  
Output: COLT, row 4, column 3, forwards

**Test your program with**

- (a) THE
  - (b) BEST
  - (c) CONTEST
- [ICPSC]

### 5. TRANSFORMATION

Some doors can be unlocked using a key card – a plastic card with holes in it. A key card may be square like this: (O means a hole, X means no hole); but it may also be a rectangle or a triangle.

```

XXXX
XXOX
XOXX
XXOX

```

However in order to work, these specific key cards have to be rotated or flipped according to one or more of these transformation instructions:

- R = Rotate 90° to the right
- T = Top to bottom flip: you see the back – upside down
- L = Left to right flip: you see the back – mirrored

**Task:**

Write a program that will take the given key card, rotate, and/or flip it as instructed, and print out the resulting key card. No card will be more than 40 by 40 spaces.

**Example:**

Input:           XXXXO  
                  XXOX  
                  XOXX  
                  XXOX

Transformation: R, L

Output:           XXXX  
                  XXOX  
                  XOXO  
                  OXXX

**Explanation:**

After rotating by 90°

```

XXXX
XXOX
XOXO
XXXX

```

After a left to right flip:

```

XXXX
XXOX
XOXO
OXXX

```

**Test your program with**

(a)           XXXXO  
                  XXOX  
                  XOXX  
                  XXOX  
Transformation: T

(b)           XXXXO  
                  XXOX  
                  XOXX  
                  XXOX  
                  XXXX  
Transformation: T, L, R

(c)            O  
                  XXO  
                  OXXXO  
                  XOOOXXX  
Transformation: R, T, L

[Allan Smithee]