



# Programming Olympiad 2012: Round 1

- This paper is for ALL candidates.
- Each correct answer earns 5 marks.
- You have 2 hours to attempt as many questions as possible.
- After that you may be given up to 30 minutes to print your results.
- Programs that produce 3 correct answers can earn additional marks for readability, conciseness, and for appropriate comments and variable names.

## Question 1: Telephone Directory

By Phoenix Rhymer of Durban Road High

In a telephone directory the names of streets and suburbs are shortened by removing all vowels (a, e, i, o, u) unless the vowel appears at the beginning of a word, in which case it is kept.

Write a program that will automatically shorten any address in this manner. Punctuation and numbers must be reproduced as in the input.

### Example 1:

**Input:** Woodside  
**Output:** Wdsd

### Example 2:

**Input:** Observatory  
**Output:** Obsrvtry

### Record the results of the following test cases:

- Johannesburg
- Apple Street, Claremont
- 21 Cavendish Avenue, eThekwin

## Question 2: Security Digit

By Allen Smithee of Hoërskool Hulsbos

To check whether an account number is genuinely a number allocated by the bank, the Pomme Bank of Paris uses the following technique. All the non-zero digits in the number are multiplied by each other. All the non-zero digits of the resulting number are again multiplied by each other – and so on until a single digit is left. That is the security digit.

Write a program that will provide the security digit for any number with up to 20 digits.

### Example 1:

**Input:** Number? 469795  
**Output:** Security digit = 8

### Example 2:

**Input:** Number?1234239003  
**Output:** Security digit = 9

### Record the results of the following test cases:

- 193
- 901090506
- 1567890123

## Question 3: Word Triangle

Adapted from the ICPSC

Any word that begins and ends with the same letter can be made into a word triangle.

Write a program that will create a word triangle from any word that begins and ends with the same letter, but that will reject a word that is not suitable with the output: "Not suitable".

### Example 1:

**Input:** CUBIC  
**Output:**

```

C
U I
B B
I U
C U B I C

```

### Example 2:

**Input:** AFRICA  
**Output:**

```

A
F C
R I
I R
C F
A F R I C A

```

### Record the results of the following test cases:

- NOON
- ELIZABETH
- ELABORATE



## Question 4: Justifying Text

Adapted from the ICPSC

Write a program that will take the provided text and print it out in a column of a specified width (just like in a newspaper). Words at the end of a line that would end beyond the length specified, must be moved to the next line. Spaces must be added between the words so that each line is exactly the specified width and the spaces are as evenly distributed over the line as possible. If only one word fits in a line, that word must be left-aligned. The width of a column will always be greater than or equal to nine.

Use the following text: "A *great discovery solves a great problem but there is a grain of discovery in the solution of any problem*"

### Example 1:

**Input:** Width? 20

### Output:

```
A great discovery
solves a great
problem but there is
a grain of discovery
in the solution of
any problem
```

### Example 2:

**Input:** Width? 25

### Output:

```
A great discovery solves
a great problem but there
is a grain of discovery
in the solution of any
problem
```

### Record the results of the following test cases:

- Width? 35
- Width? 60
- Width? 10

## Question 5: Toll Roads

Adapted from a problem by Phoenix Rhymer of Durban Road High

Six cities, A, B, C, D, E and F are connected by toll roads. Some roads can be zero toll roads. Write a program to work out the cheapest route to visit each city once only, starting at A and ending at A, and give the total toll to be paid. If there is more than one cheapest route, you may provide any one of them as answer. You may travel a road in any direction. The tolls are given in the following order:

A-B; A-C; A-D; A-E; A-F; B-C; B-D; B-E; B-F;  
C-D; C-E; C-F; D-E; D-F; E-F

### Example 1:

**Input:** (in Rand) 6, 3, 2, 3, 10, 1, 6, 7, 4, 5, 1, 5, 10, 7, 3

**Output:** A D C B F E A, 18

### Example 2:

**Input:** (in Rand) 10, 15, 7, 10, 7, 7, 9, 6, 7, 11, 12, 8, 5, 14, 9

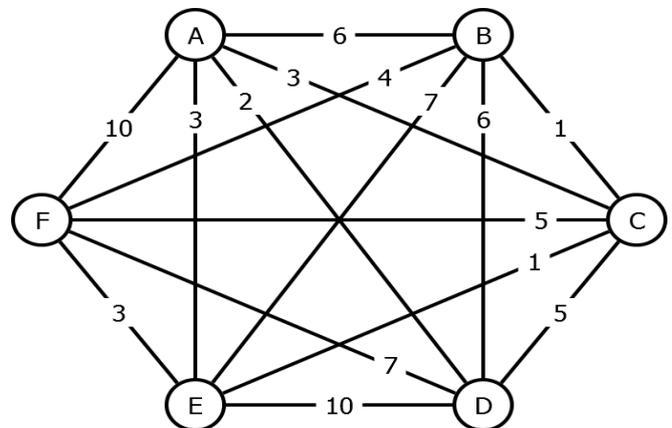
**Output:** A D E B C F A, 40

### Record the results of the following test cases:

- 9, 8, 7, 6, 5, 4, 3, 2, 1, 2, 3, 4, 5, 6, 7
- 6, 0, 7, 0, 8, 0, 1, 2, 3, 0, 5, 6, 7, 8, 9
- 12, 10, 14, 4, 11, 7, 2, 2, 10, 3, 6, 9, 8, 10, 1

### Illustration of Example 1:

(Please note: you do NOT have to produce an illustration.)



### Illustrated solution to Example 1:

