

# Programming Olympiad 2021: Round 1

Not to be used before 16 August 2021

1. This paper is for ALL participants.
2. All answers (output) must be written on the given answer sheet by **offline** participants.
3. All answers (output) must be submitted on the competition website that you received with your login (**online** participants).
4. Each correct answer for question 1, question 2 (a) and (b) and question 3 earns eight (8) marks while each correct answer for question 2 (c) and (d) earns ten (10) marks.
5. You have 60 minutes to attempt as many questions as possible.
6. Programs should be readable, concise, and use appropriate variable names.
7. Indicate the question, your name, surname, username and the language and version used in a comment statement at the start of every program, e.g. "**Q3 Sam King, username, Python 2.7**".
8. You may assume that the user input will satisfy the problem specification and so you do not need to validate the input.
9. Do not write code to produce only specific answers, as the external judges may use other test cases.
10. Make sure you upload your programs before you log off, and as an extra precaution, save the programs you have created in a place where your teacher can find them.
11. **DO NOT MODIFY ANY FILES AFTER THE END OF THE CONTEST AS THIS WILL LEAD TO YOUR DISQUALIFICATION.**
12. **USE OF OTHER WEBSITES:** Any attempt to access any other website or source of information during the competition will disqualify you.
13. Results will be sent to schools by 25 August.

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## Question 1 – Determinant

Kevin, a university student, is struggling with his mathematics homework and can't find his calculator. Help him find the correct answers for the following mathematical operation.

Given as input 4 space-separated integers a b c d, write a program to output the value  $ad - bc$ . The value of each integer is between -10000 and 10000.

**Example:** 4 5 2 3

**Answer:** 2 ( $4*3 - 5*2$ )

## Test your program with the following cases:

Give your answer as a number only with no spaces, e.g. 1234

1a) 4 -2 6 3

1b) 6 7 7 7

1c) 78 21 43 65

1d) 9999 -400 173 77

## Question 2 – Sum of Series

Write a program to determine the sum of the first  $n$  terms of the following series:

$1/2 + 2/3 + 3/4 + 4/5 + 5/6 + \dots$ , where  $n$  is between 1 and 10000. Output the answer rounded off to 2 decimal places.

Note: A value between 0.005 and 0.009 rounds off to 0.01, while a value between 0.001 and 0.004 rounds off to 0.00. For this question only, your program does not have to do the rounding; you may round off by hand.

**Example:**  $n = 4$

**Answer:** 2.72 (rounded off from 2.716666)

**Test your program with the following cases:** Give your answer as a number only with no spaces, e.g. 1234

- 2a)  $n = 2$
- 2b)  $n = 10$
- 2c)  $n = 9999$
- 2d)  $n = 10000$

## Question 3 – Carpet

Aladdin has decided that being a prince is overrated, and so has opened an online carpet shop.

In Aladdin's shop the price of a carpet depends on the length of the carpet and the number of different colours used. In his computer system, a carpet is represented by a string of letters, e.g., zbbcbbx, where each character represents the colour of a fixed stretch of carpet. Note that the total length of the string would be the same as the total length of the carpet. Ultimately, the price of a carpet is the length of the carpet multiplied by the number of different colours used.

Write a program that, when given a string representing a carpet, outputs its price.

**Example:** abacx

**Answer:** 20 (length 5 multiplied by 4 different types)

**Test your program with the following cases:**

(each case should be input as a single line)

Give your answer as a number only with no spaces, e.g. 1234

- 3a) qiraat
- 3b) cdefghijklmnopqrstuvwxyz
- 3c) warrior
- 3d) supercalifragilisticexpialidocious