

Problem 1

Read two natural numbers. Then, define a logical variable and initialize it with `true` if and only if at least one of the numbers 2, 3 and 5 is a common divisor of the two numbers read.

Problem 2

Define in your program four numbers of type `int` — `a1`, `a2`, `b1`, `b2` — which we interpret as coordinates on the number axis of end points of two intervals: $A = [a_1, a_2]$ and $B = [b_1, b_2]$. The program reads from the user one number (say, `x`) of type `int` and prints whether it is true that

- $x \in A$
- $x \in B$
- $x \in A \setminus B$
- $x \in B \setminus A$
- $x \in A \cap B$
- $x \in A \cup B$
- $x \in A \ominus B$

where \setminus denotes the set difference and \ominus the symmetric difference (quite often the Δ symbol is used).

For example, if the defined intervals are $A = [2, 4]$ and $B = [1, 6]$ and the number read is $x = 5$, the program should print something like:

```
Interval A = [2, 4]
Interval B = [1, 6]
Enter x 5
x in A:                false
x in B:                true
x in A\B:              false
x in B\A:              true
x in intersection of A and B: false
x in union of A and B:  true
x in symm. diff. of A and B: true
```

Do not use `if` statements (use logical variables instead).

Problem 3

Write a program which reads integers from the user until he/she enters 0 (which merely signals *end of input* is not taken in further considerations). Then the program prints the information whether in this series of numbers there were as many odd numbers as even ones.

Problem 4

Write a program which reads from the user three non-negative integers and then prints, using symbols '*', a 'histogram' of the data represented by the numbers, i.e., three vertical bars, aligned at the bottom, with heights equal to the values of the three numbers.

For example, for numbers 3, 1 and 8 the result should look like this:

```
      *
      *
      *
      *
      *
*  *
*  *
***
```

Do not use arrays, strings or any other kind of collections.

Problem 5

Write a program reading integers until zero is entered and printing the length of the longest sequence of consecutive numbers of the same value (and this value).

For example, for

```
2 2 2 2 3 3 3 2 6 6 6 0
```

the result should be

```
Longest sequence: 4 times 2
```

for

```
2 2 2 3 3 3 3 3 2 6 6 6 0
```

the result should be

```
Longest sequence: 5 times 3
```

and for

```
2 2 333 333 2 3 -66 -66 -66 0
```

it should be

```
Longest sequence: 3 times -66
```

Do not use arrays, strings or any other kind of collections.

Check your solutions for different cases: when the longest sequence is at the beginning, somewhere in the middle, or at the very end.

Problem 6

Random variables a , b , c , have uniform distribution on the interval $[0, 1)$ and are independent. Estimate, using sufficient number of random trials (e.g., 10 000 000), the probability that the equation $ax^2 + bx + c = 0$ has a real solution. Compare the result with the value $(5 + 3 \ln 4)/36 \approx 0.25441342$.
