

SEMINAR 1
Solutions

1. Solve the quadratic equation $ax^2 + bx + c = 0$. Complete discussion.

```
start
read a,b,c
if a  $\neq$  0 then
    assign delta  $\leftarrow b^2 - 4*a*c$ 
    if delta > 0 then
        assign x1  $\leftarrow (-b - \text{sqrt}(\text{delta}))/2/a$ 
        assign x2  $\leftarrow (-b + \text{sqrt}(\text{delta}))/2/a$ 
        write "Two real solutions"
        write x1,x2
    else
        if delta = 0 then
            assign x1  $\leftarrow -b/2/a$ 
            assign x2  $\leftarrow -b/2/a$ 
            write "Two real equal solutions"
            write x1,x2
        else
            assign x1  $\leftarrow -b/2/a$ 
            assign x2  $\leftarrow \text{sqrt}(-\text{delta})/2/a$ 
            write "Complex solutions: real part, imaginary part"
            write x1,x2
        _ □
    _ □
else
    if b  $\neq$  0 then
        write "First-degree equation"
        assign x1  $\leftarrow -c/b$ 
        write x1
    else
        if c  $\neq$  0 then
            write "Impossible equation"
        else
            write "Indeterminate equation"
        _ □
    _ □
_ □
stop
```

2. We suppose that we have to process n terms (n taken from the console). Compute the product of non-zero terms and determine the number of null terms introduced from the console.

```
start
read n
assign num_zero  $\leftarrow$  0
assign p  $\leftarrow$  1
for i = 1,n execută
    read x
    if x  $\neq$  0 then
        assign p  $\leftarrow$  p * x
    else
        assign num_zero  $\leftarrow$  num_zero + 1
    _ □
_ □
if num_zero  $\neq$  0 then
    write num_zero, p
else
    write "No non-zero terms"
stop
```

3. Read a sequence of numbers from the console as long as a negative number is not introduced. Compute the arithmetic mean of the numbers.

```
start
assign s ← 0
assign nr_term ← 0
read x
while x > 0 do
|   assign s ← s + x
|   assign nr_term ← nr_term + 1
|   read x           // read the new current term
|_□
if nr_term ≠ 0 then
|   assign ma ← s / nr_term
|   write ma
| else
|   write "No positive terms"
stop
```

4. Read a sequence of numbers from the console as long as their sum does not exceed a defined value MAX. Compute the number of introduced terms and their sum.

```
start
assign MAX ← 1000           // initializing the maximum imposed value
assign nr_term ← 0
assign s ← 0
repet
|   read x                 // read current term
|   assign s ← s + x
|   assign nr_term ← nr_term + 1
while s ≤ MAX
assign s ← s - x
assign nr_term ← nr_term - 1
write nr_term, s
stop
```

5. The series expansion of the function $\sin(x)$ is given by:

$$\sin(x) = x / 1! - x^3 / 3! + x^5 / 5! - \dots$$

Calculate the approximate value of $\sin(x)$, for value of x taken from the console, with an error smaller than epsilon.

Note: It is proved that the module of approximation error is less than a given epsilon value when the module of the next term to be added to the sum is less than epsilon.

```
start
read x, eps
assign sin_apr ← 0
assign k ← 1
assign t ← x

while |t| ≥ eps do
|   assign sin_apr ← sin_apr + t
|   assign t ← -x2 * t / (2*k) / (2*k+1)
|   assign k ← k + 1
|_□
write sin_apr
stop
```