BABEȘ-BOLYAI UNIVERSITY
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Admission exam – September 9th, 2025

Written Exam for Computer Science

IMPORTANT NOTE:
Unless otherwise specified:

- All arithmetic operations are performed on unlimited data types (there is no *overflow* / *underflow*).
- Arrays, matrices and strings are indexed starting from 1.
- All restrictions apply to the values of the actual parameters at the time of the initial call.
- A subarray of an array or a string consists of elements that occupy consecutive positions in the array or in the string.
- If on the same row there are several consecutive assignment statements, they are separated by "; ".

1. Consider the algorithm `cauta(a, n, b, m)`, where ***a*** and ***b*** are two strings with ***n*** and ***m*** characters respectively (***a***[1], ***a***[2], ..., ***a***[***n***], ***b***[1], ***b***[2], ..., ***b***[***m***], $1 \leq n, m \leq 100$ and $m \leq n$).

Which of the following implementations of the algorithm `cauta(a, n, b, m)` return the position in string ***a*** from which string ***b*** first appears as a subarray in string ***a,*** or -1 if string ***b*** does not appear in string ***a***?

A.
```
Algorithm cauta(a, n, b, m):
    i ← 1
    While i < n – m + 2 execute
        j ← 1
        While j ≤ m AND a[i + j - 1] = b[j] execute
            j ← j + 1
        EndWhile
        If j > m then
            Return i
        EndIf
        i ← i + 1
    EndWhile
    Return -1
EndAlgorithm
```

B.
```
Algorithm cauta(a, n, b, m):
    If n = m then
        Return 1
    EndIf
    For i ← 1, n - m + 1 execute
        If a[i] = b[i] AND a[i + m - 1] = b[m] then
            Return i
        EndIf
    EndFor
    Return -1
EndAlgorithm
```

C.
```
Algorithm cauta(a, n, b, m):
    For i ← 1, n - m + 1 execute
        k ← True; j ← 1
        While k AND j ≤ m execute
            If a[i + j - 1] ≠ b[j] then
                k ← False
            EndIf
            j ← j + 1
        EndWhile
        If k then
            Return i
        EndIf
    EndFor
    Return -1
EndAlgorithm
```

D.
```
Algorithm cauta(a, n, b, m):
    i ← 1
    While i ≤ n - m execute
        j ← 1
        While j ≤ m AND a[i + j - 1] = b[j] execute
            j ← j + 1
        EndWhile
        If j > m then
            Return i
        EndIf
        i ← i + 1
    EndWhile
    Return -1
EndAlgorithm
```

2. Consider the algorithm `S(n)`, where ***n*** is an integer number ($0 \leq n \leq 10^4$).

```
Algorithm S(n):
    If n = 0 then
        Return 0
    EndIf
    Return n + S(n DIV 2)
EndAlgorithm
```

Which of the following statements are true?

A. The time complexity of the algorithm is $O(\log n)$.
B. The algorithm computes the sum of the first ***n*** natural numbers.
C. After the call `S(4)`, the value 12 is returned.
D. The expression `S(2) + S(13) = S(7) + S(8)` has the value *True*.

3. Which of the following implementations of the `gcd(a, b)` algorithm return the greatest common divisor of the natural numbers a and b ($1 \leq a, b \leq 100$)?

A.
```
Algorithm gcd(a, b):
    If b = 0 then
        Return b
    EndIf
    If a > b then
        Return gcd(a - b, b)
    Else
        Return gcd(a, b - a)
    EndIf
EndAlgorithm
```

B.
```
Algorithm gcd(a, b):
    If b = 0 then
        Return 0
    EndIf
    Return gcd(b, a MOD b)
EndAlgorithm
```

C.
```
Algorithm gcd(a, b):
    While b > 0 execute
        c ← a; a ← b; b ← c MOD a
    EndWhile
    Return a
EndAlgorithm
```

D.
```
Algorithm gcd(a, b):
    While a MOD b > 0 execute
        c ← a; a ← b; b ← c MOD a
    EndWhile
    Return b
EndAlgorithm
```

4. Consider the algorithm `f(n, x, k)`, where n is a natural number ($1 \leq n \leq 10^4$), x is an array of n integer elements ($x[1]$, $x[2]$, ..., $x[n]$, $-10^3 \leq x[i] \leq 10^3$, for $i = 1, 2, ..., n$), and k is a natural number ($1 \leq k \leq 10^4$):

```
Algorithm f(n, x, k):
    For i ← 1, k execute
        a ← x[1]
        j ← 1
        While j < n execute
            x[j] ← x[j + 1]
            j ← j + 1
        EndWhile
        x[n] ← a
    EndFor
    Return x[1]
EndAlgorithm
```

Which of the following statements are true?

A. If $n = 10$, $x = [1, 2, 3, ..., 10]$, and $k = 3$, the algorithm returns 6.
B. If $n = 10$, $x = [1, 2, 3, ..., 10]$, and $k = 117$, the algorithm returns 8.
C. If $n = 5$, $x = [4, 2, 5, 11, 13]$, and $k = 117$, the algorithm returns 5.
D. If $n = 5$, $x = [1, 2, 3, 4, 5]$, the algorithm returns the same value if $k = 3$ or $k = 318$.

5. Consider the algorithm `ceFace(n)`, where n is a natural number ($1 \leq n \leq 10^9$).

```
Algorithm ceFace(n):
    a ← 0; b ← 0
    For i ← 0, 9 execute
        x ← n
        c ← 0
        While x > 0 execute
            If x MOD 10 = i then
                c ← c + 1
            EndIf
            x ← x DIV 10
        EndWhile
        If c ≠ 0 then
            a ← a + 1
            If i MOD 2 = c MOD 2 then
                b ← b + 1
            EndIf
        EndIf
    EndFor
    Return a = b
EndAlgorithm
```

Which of the following statements are true?

A. The `ceFace(n)` algorithm returns *True* if in the number n the number of distinct even digits equals the number of distinct odd digits.
B. If $n = 12235$, the `ceFace(n)` algorithm returns *True*.
C. If n consists only of odd digits, the `ceFace(n)` algorithm returns *True*.
D. If $n = 10^k$ where k is an even number, the `ceFace(n)` algorithm returns *True*.

6. Consider the algorithm `numar(n)`, where ***n*** is a natural number ($1 \leq n \leq 10^6$).

```
Algorithm numar(n):
    While n > 9 execute
        n ← n DIV 10 + n MOD 10
    EndWhile
    Return n
EndAlgorithm
```

Which of the following statements are true?

A. The value returned by the algorithm is in the set {1, 2, ..., 9}, for any value of ***n***.
B. The algorithm does not return the value 0 for any value of ***n***.
C. There are 3 distinct values ***v*** for which if `numar(n) = v`, then ***n*** is divisible by ***v***, regardless of the value of ***n***.
D. The algorithm returns the sum of the digits of the number ***n.***

7. Consider the binary number $b = 110101011_{(2)}$.

Which of the following statements are true regarding the number ***b***?

A. In base 4 it has the value $12223_{(4)}$.
B. In base 8 it is a palindrome number.
C. It is an odd number.
D. It is a number divisible by 3.

8. Consider the algorithm `f(a, b, n, d)`, where ***a*** and ***b*** are natural numbers ($1 \leq a, b \leq 10^9$), $n = 3$ and $d = [5, 7, 11]$:

```
Algorithm f(a, b, n, d):
    c ← 0
    p ← 1
    g ← False
    While NOT g execute
        For i ← 1, n execute
            If (a MOD d[i] = 0) OR (b MOD d[i] = 0) then
                c ← c * 10 + 1
                p ← p * i
            EndIf
        EndFor
        g ← NOT g
    EndWhile
    Return c * 100 + p
EndAlgorithm
```

Which of the following statements are true?

A. If $a * b$ is not divisible by 5, by 7, or by 11, after the call `f(a, b, 3, [5, 7, 11])` the value 1 is returned.
B. If $a * b$ is not divisible by 5, by 7, or by 11, when calling the algorithm `f(a, b, 3, [5, 7, 11])`, the last value assigned to ***c*** is 10.
C. If $a * b$ is divisible by 5, by 7, and by 11, after the call `f(a, b, 3, [5, 7, 11])` the value 11106 is returned.
D. After the call `f(112233, 331122, 3, [5, 7, 11])` the value 1003 is returned.

9. Consider the algorithm `f(x, n)`, where ***n*** is a natural number ($3 \leq n \leq 10^4$), and ***x*** is an array of ***n*** natural numbers ($x[1], x[2], ..., x[n]$, $1 \leq x[i] \leq 10^4$, for $i = 1, 2, ..., n$):

```
Algorithm f(x, n):
    For i ← 1, n - 1 execute
        If x[i + 1] < x[i] then
            tmp ← x[i + 1]
            x[i + 1] ← x[i]
            x[i] ← tmp
        EndIf
    EndFor
EndAlgorithm
```

Which of the following statements are true?

A. After the call `f(x, n)`, the largest element in array ***x*** will be on position ***n***.
B. After the call `f(x, n)`, the smallest element in array ***x*** will be on position ***n***.
C. After the call `f(x, n)`, array ***x*** will be sorted ascending.
D. After the call `f(x, n)`, array ***x*** will be sorted descending.

10. Consider the algorithm `F(n)`, where ***n*** is an integer number ($0 < n < 10^5$).

```
Algorithm F(n):
    If n = 0 then
        Return 0
    Else
        If n MOD 2 = 0 then
            Return F(n DIV 10) + 1
        Else
            Return F(n DIV 10) - 1
        EndIf
    EndIf
EndAlgorithm
```

Which of the following statements are true?

A. If $n = 543$, the algorithm returns 2.
B. If $n = 18$, the algorithm returns 0.
C. If $n = 41173$, the algorithm returns 3.
D. For no number ***n*** in the interval [111, 999] does the algorithm `F(n)` return 0.

11. Consider the algorithm `ceFace(x, n)`, where n is a natural number ($1 \leq n \leq 10^4$), and x is an array of n integer elements ($x[1], x[2], ..., x[n]$, $0 \leq x[i] \leq 10^4$, for $i = 1, 2, ..., n$):

```
Algorithm ceFace(x, n):
    i ← 1
    c ← 0
    d ← 0
    While i ≤ n execute
        If (x[i] MOD 10) MOD 2 = 0 then
            c ← c + 1
        Else
            If (x[i] MOD 10) MOD 3 = 0 then
                d ← d + 1
            EndIf
        EndIf
        i ← i + 1
    EndWhile
    Return c = d
EndAlgorithm
```

In which of the following conditions does the `ceFace(x, n)` algorithm return *True*?

A. If the number of even numbers in the array is equal to the number of odd numbers in the array.
B. If the number of numbers in the array that are divisible by 2 is equal to the number of numbers in the array that are multiples of 6.
C. If the number of even numbers in the array is equal to the number of odd numbers in the array that have the last digit a multiple of 3.
D. If the number of numbers in the array that are divisible by 2 is equal to the number of numbers in the array that are multiples of 3.

12. Consider the algorithm `f(n, x, c)`, where n is a natural number ($1 \leq n \leq 10^4$), x is an array of n integer elements ($x[1], x[2], ..., x[n]$, $-10^3 \leq x[i] \leq 10^3$, for $i = 1, 2, ..., n$), and c is a natural number ($1 \leq c \leq n$):

```
Algorithm f(n, x, c):
    For i ← 1, c execute
        For j ← 1, n - 1 execute
            If x[j] > x[j + 1] then
                aux ← x[j]
                x[j] ← x[j + 1]
                x[j + 1] ← aux
            EndIf
        EndFor
    EndFor
    Return x[n + 1 - c]
EndAlgorithm
```

Which of the following statements are true?

A. After the call `f(5, [5, 4, 30, 5, 1], 3)` the algorithm will return 5.
B. If x contains the values 100, 99, 98, ..., 1, $n = 100$, and $c = 50$, the algorithm `f(n, x, c)` will return 51.
C. If $c = n$, the algorithm `f(n, x, c)` will return the minimum element of array x.
D. If $c = 1$, the algorithm `f(n, x, c)` will return the minimum element of array x.

13. Consider the algorithm `afla(n, x)`, where n is a natural number ($3 \leq n \leq 10^4$), and x is an array of n integer elements ($x[1], x[2], ..., x[n]$, $-100 \leq x[i] \leq 100$, for $i = 1, 2, ..., n$).

```
Algorithm afla(n, x):
    M ← x[1]
    For i ← 1, n - 2 execute
        For j ← i + 1, n - 1 execute
            For k ← j + 1, n execute
                If M < x[i] + x[j] + x[k] then
                    M ← x[i] + x[j] + x[k]
                EndIf
            EndFor
        EndFor
    EndFor
    Return M
EndAlgorithm
```

Which of the following statements are true after the call `afla(n, x)`?

A. If all elements of array x are negative, the value of the element $x[1]$ is returned.
B. If all elements of array x are positive but less than or equal to $x[1]$, the value of the element $x[1]$ is returned.
C. If $x[1]$, $x[2]$, and $x[3]$ are positive numbers, their sum is returned.
D. For any array x with n elements, where the product of all elements is an odd number, the algorithm `afla(n, x)` returns an odd number.

14. Specify how many distinct unoriented graphs with 5 nodes, numbered from 1 to 5, can be constructed, so that node 3 has degree 1. Two graphs are distinct if their adjacency matrices are different.

A. 2^8 B. 5! C. $5 * C_5^4$ D. 2^5

15. Consider the algorithm `ceFace(A, n)`, where n is a natural number ($1 < n \leq 10$), A is a matrix with $n \times n$ natural numbers ($A[1][1], A[1][2], ..., A[n][n]$, $1 \leq A[i][j] \leq 10$, for $i, j = 1, 2, ..., n$).

```
Algorithm ceFace(A, n):
    c ← 0
    For i ← 2, 3 execute
        first ← modifica(A, n, i - 1, i, 2, 4)
        second ← modifica(A, n, i, i - 1, 3, 2)
        If first AND second then
            c ← c + 1
        EndIf
    EndFor
    Return c
EndAlgorithm
```

```
Algorithm modifica(A, n, r, c, x, nr):
    If (r + x - 1 > n) OR (c + x - 1 > n) then
        Return False
    EndIf
    For i ← r, r + x - 1 execute
        For j ← c, c + x - 1 execute
            A[i][j] ← A[i][j] * nr
        EndFor
    EndFor
    Return True
EndAlgorithm
```

If $n = 4$ and the initial matrix A is $\begin{pmatrix} 4 & 8 & 3 & 4 \\ 2 & 5 & 6 & 8 \\ 4 & 3 & 2 & 9 \\ 5 & 3 & 1 & 7 \end{pmatrix}$, which of the following statements are true after the call `ceFace(A, n)`?

A. The sum of the elements on the main diagonal of the modified matrix is 95.
B. In the modified matrix there are twice as many elements divisible by 2 as in the original matrix.
C. The returned value is 1.
D. The sum of the elements on the main diagonal of the modified matrix is 67.

16. Consider the algorithm `buildMatrix(n, x, m, y)`, where n and m are natural numbers ($1 \leq n, m \leq 100$), x and y are arrays with n, respectively m integer elements ($x[1], x[2], ..., x[n]$, where $-10^3 \leq x[i] \leq 10^3$, for $i = 1, 2, ..., n$ and $y[1], y[2], ..., y[m]$, where $-10^3 \leq y[j] \leq 10^3$, for $j = 1, 2, ..., m$). The `max(a, b)` algorithm returns the maximum value between numbers a and b. The `zeros(n, m)` algorithm returns a matrix with n rows and m columns, with all elements equal to 0.

```
Algorithm buildMatrix(n, x, m, y):
    A ← zeros(n + 1, m + 1)
    For i ← 1, n execute
        For j ← 1, m execute
            If x[i] = y[j] then
                A[i + 1][j + 1] ← A[i][j] + 1
            Else
                A[i + 1][j + 1] ← max(A[i][j + 1], A[i + 1][j])
            EndIf
        EndFor
    EndFor
    Return A[n + 1][m + 1]
EndAlgorithm
```

Which of the following statements are true?

A. After the call `buildMatrix(3, [3,2,3], 3, [2,3,3])` the algorithm returns the value 2.
B. The `buildMatrix(n, x, m, y)` algorithm returns the value 0 if and only if x and y have the same length and have no common elements.
C. If $n = m$, and the elements of array y represent a permutation of the elements of array x, then the `buildMatrix(n, x, m, y)` algorithm will return the value n.
D. There exist input data for which the value returned by the algorithm is equal to $n + m$.

17. Consider the algorithm `h(A, n, p)`, where n and p are natural numbers ($1 \leq n, p \leq 10^3$), and A is an array with n natural number elements ($A[1], A[2], ..., A[n]$, where $1 \leq A[i] \leq 100$, for $i = 1, 2, ..., n$):

```
Algorithm h(A, n, p):
    t ← n + 1; j ← 1; s ← 0
    For i ← 1, n execute
        s ← s + A[i]
        While s > p execute
            If t > i – j + 1 then
                t ← i – j + 1
            EndIf
            s ← s - A[j]
            j ← j + 1
        EndWhile
    EndFor
    Return t
EndAlgorithm
```

After which calls will the value 3 be returned?

A. `h([2, 1, 5, 6, 2, 5], 6, 11)`
B. `h([2, 1, 5, 6, 2, 5], 6, 10)`
C. `h([7, 8, 1, 2], 4, 15)`
D. `h([7, 8, 1, 2], 4, 16)`

18. Consider the algorithm `matrice(mat, n)`, where ***mat*** is a matrix with ***n*** rows and ***n*** columns ($3 \leq n \leq 200$) with natural number elements (***mat***[1][1], ***mat***[1][2], ..., ***mat***[***n***][***n***], $1 \leq mat[i][j] \leq 10^4$, for $i = 1, 2, ..., n$, $j = 1, 2, ..., n$). The "/" operator represents the division of real numbers; for example, 7 / 2 = 3.5.

```
Algorithm matrice(mat, n):
   c ← 0
   For i ← 1, n execute
      For j ← 1, n execute
         ... // (1)
            c ← c + mat[i][j]
         EndIf
      EndFor
   EndFor
   ... // (2)
EndAlgorithm
```

With what instructions should the lines marked `(1)` and `(2)` in the algorithm `matrice(mat, n)` be replaced so that the algorithm returns the average of the elements that are not on the diagonals of the matrix?

A.
```
(1) If i ≠ j AND i ≠ n – j - 1 then
(2) Return c / (n * n – 2 * n + 1)
```

B.
```
(1) If i ≠ j OR i + j ≠ n + 1 then
(2) Return c / (n * n – 2 * n)
```

C.
```
(1) If i ≠ j AND i + j ≠ n + 1 then
(2) Return c / (n * n – 2 * n + n MOD 2)
```

D.
```
(1) If i ≠ j AND i ≠ n – j - 1 then
(2) Return c / (n * n – 2 * n + n MOD 2)
```

19. Consider the algorithm `f(x, n)`, where ***n*** is a natural number ($2 \leq n \leq 10^3$), and ***x*** is an array of ***n*** natural numbers (***x***[1], ***x***[2], ..., ***x***[***n***], $0 \leq x[i] \leq 100$, for $i = 1, 2, ..., n$).

```
Algorithm f(x, n):
    left ← 1
    right ← n
    g ← True
    While left < right execute
        max ← -1
        For i ← left, right execute
            If x[i] > max then
               max ← x[i]
               poz1 ← i
            EndIf
        EndFor
        If g then
            poz2 ← left
            left ← left + 1
        Else
            poz2 ← right
            right ← right - 1
        EndIf
        If poz1 ≠ poz2 then
            x[poz1] ← x[poz2] // (*)
            x[poz2] ← max
        EndIf
        g ← NOT g
    EndWhile
    Return x
EndAlgorithm
```

Which of the following statements are true?

A. For a given array ***x*** of ***n*** elements, the `f(x, n)` call returns the same result for any permutation of the array's elements.
B. If $n = 10$ and $x = [1, 2, 3, \ldots, 10]$, after the call `f(x, n)` the line marked (*) will be executed 9 times.
C. If array ***x*** is sorted in ascending order, after the call `f(x, n)` the line marked (*) is executed the same number of times as when array ***x*** is sorted in descending order.
D. If $n = 100$ and $x = [1, 2, 3, \ldots, 100]$, there exists a single permutation of the elements of array ***x*** so that after the call `f(x, n)` the line marked (*) is not executed.

20. Consider the algorithm `rezultat(azi, zile)`, where ***azi*** ($1 \leq azi \leq 5$), is a natural number that represents a workday (a value of 1 corresponds to Monday, a value of 2 corresponds to Tuesday, ..., a value of 5 corresponds to Friday, respectively), and ***zile*** ($1 \leq zile \leq 100$) is a natural number.

The `rezultat(azi, zile)` algorithm returns the workday on which the result of a medical analysis is released, considering the required processing time, expressed in the number of calendar days through the value of the ***zile*** variable. Analyses are processed every day of the week, and results are released on the first workday on which they are available. If processing is completed during the week-end (on a Saturday or Sunday), the result is released on the next Monday.

For example, after the call `rezultat(2, 1)` the value 2 will be returned (the result is released on the same day), and after the call `rezultat(3, 4)` the value 1 will be returned (the result is released on Monday).

```
Algorithm rezultat(azi, zile):
    For i ← 2, zile execute
        azi ← azi + 1
        If azi > 7 then
            azi ← 1
        EndIf
    EndFor
    If azi ≥ 6 then
        azi ← 1
    EndIf
    Return azi
EndAlgorithm
```

Which of the following statements are true?

A. The `rezultatRec(azi, zile)` algorithm returns the same value as the `rezultat(azi, zile)` algorithm for any input data.

```
Algorithm rezultatRec(azi, zile):
    If zile = 0 then
        If azi > 5 then
            Return 1
        EndIf
        Return azi
    EndIf
    Return rezultatRec(azi + 1, zile - 1)
EndAlgorithm
```

B. After the call `rezultat(4, 25)` the value 1 is returned.

C. The `rezultat2(azi, zile)` algorithm returns the same value as the `rezultat(azi, zile)` algorithm for all input data, and it has a smaller time complexity:

```
Algorithm rezultat2(azi, zile):
    v ← ((azi + zile - 2) MOD 7) + 1
    If v > 5 then
        v ← 1
    EndIf
    Return v
EndAlgorithm
```

D. The time complexity of the `rezultat(azi, zile)` algorithm is $O(1)$.

21. Consider the algorithm `suma(A, n, m, x1, y1, x2, y2)` that computes the sum of the elements in a region of the matrix A. A is a matrix of dimensions $n \times m$ ($A[1][1]$, $A[1][2]$, ..., $A[1][m]$, $A[2][1]$, ..., $A[n][m]$, where $2 < n, m < 100$, $0 \leq A[i][j] \leq 10^3$ for $i = 1, 2, \ldots n$, $j = 1, 2, \ldots, m$). The rectangular region of interest is defined by the coordinates of the upper left corner ($x1$, $y1$) and the lower right corner ($x2$, $y2$), where $1 \leq x1 < x2 \leq n$, $1 \leq y1 < y2 \leq m$. The `zeros(a, b)` algorithm returns a matrix with a rows and b columns, where all elements are initialized with 0.

```
Algorithm compute(A, n, m):
    aux ← zeros(n, m)
    For i ← 1, n execute
        For j ← 1, m execute
            aux[i][j] ← A[i][j]
            If j > 1 then
                aux[i][j] ← aux[i][j] + aux[i][j - 1]
            EndIf
            If i > 1 then
                aux[i][j] ← aux[i][j] + aux[i - 1][j]
            EndIf
            If j > 1 AND i > 1 then
                aux[i][j] ← aux[i][j] - aux[i - 1][j - 1]
            EndIf
        EndFor
    EndFor
    Return aux
EndAlgorithm
```

```
1. Algorithm suma(A, n, m, x1, y1, x2, y2):
2.     aux ← compute(A, n, m)
3.     S1 ← 0; S2 ← 0; S3 ← 0; S4 ← 0
4.     If x1 > 1 AND y1 > 1 then
5.         S1 ← aux[x1 - 1][y1 - 1]
6.     EndIf
7.     If x1 > 1 then
8.         S2 ← aux[x1 - 1][y2]
9.     EndIf
10.    If y1 > 1 then
11.        S3 ← aux[x2][y1 - 1]
12.    EndIf
13.    S4 ← aux[x2][y2]
14.    ..............
15. EndAlgorithm
```

What instruction must be inserted on line 14 for the algorithm `suma(A, n, m, x1, y1, x2, y2)` to return the required sum?

A. `Return S4 - S2 - S3 + S1`

B. `Return S4 + S2 + S3 + S1`

C. `Return S4 - S2 + S3 + S1`

D. `Return S4 - S2 - S3 - S1`

22. Consider the algorithm `f(n, x)` where n is a natural number ($3 \leq n \leq 10^4$), and x is an array of n natural numbers ($x[1], x[2], ..., x[n]$, $1 \leq x[i] \leq 10^4$, for $i = 1, 2, ..., n$).

```
Algorithm f(n, x):
    For i ← 1, n - 1 execute
        x[i + 1] ← (x[i + 1] * x[i]) DIV g(x[i], x[i + 1])
    EndFor
    Return x[n]
EndAlgorithm
```

```
Algorithm g(a, b):
    If a = b then Return a EndIf
    If a > b then Return g(a - b, b) EndIf
    Return g(a, b - a)
EndAlgorithm
```

Which of the following statements are true?

A. After the call `f(5, [12, 16, 8, 40, 24])` the value 240 is returned.
B. The total number of calls of the algorithm `g(a, b)` is higher in the case of the call `f(5, [8, 12, 16, 24, 40])` than in the case of the call `f(5, [40, 24, 16, 12, 8])`.
C. The algorithm returns the greatest common divisor of all elements in the array x.
D. For an array x with $n = 10$ elements containing a single value equal to 17, the rest of the values being equal to 1, the maximum number of calls of the algorithm `g(a, b)`, including the initial call, is 153.

23. For a football match between teams **A** and **B** in which 3 goals are scored and which ends with a score of 2 - 1 for team **A**, the goals can be scored in 3 sequences:

1. 0 - 0, 0 - 1, 1 - 1, 2 - 1
2. 0 - 0, 1 - 0, 1 - 1, 2 - 1
3. 0 - 0, 1 - 0, 2 - 0, 2 – 1

For example, in sequence 1., the game starts from the score of 0 - 0, team **B** scores (0 - 1), team **A** draws (1 - 1), and team **A** scores (2 - 1).

How many possible sequences are there for a 4-goal game?

A. 4!
B. 16
C. 64
D. 1! + 2! + 3! + 2! + 1!

24. Consider the algorithm `litere(v, n)`, where v is a string with n elements ($1 \leq n \leq 100$) that are uppercase in the English alphabet. For each element at position i ($1 \leq i \leq n$) in the string the value $S[i]$ is computed, which represents the number of positions $j \in \{1, 2, ..., i\}$ on which there are letters that precede the letter $v[i]$ in the alphabet. For example, if v = `['E', 'X', 'A', 'M', 'E', 'N']`, the value of $S[6]$ is 4, because the letters `'E'`, `'A'` and `'M'` precede the letter `'N'` in the alphabet. For the character type, comparison and subtraction operations are performed on the ASCII code of the operands.
Which of the following algorithms returns the sum of all $S[i]$ values ($i = 1, 2, ..., n$)?

A.
```
Algorithm litere(v, n):
    sum ← 0
    For i ← 2, n execute
        For j ← 1, i execute
            If v[j] - 'A' > v[i] - 'A' then
                sum ← sum + 1
            EndIf
        EndFor
    EndFor
    Return n * (n - 1) DIV 2 - sum
EndAlgorithm
```

B.
```
Algorithm litere(v, n):
    sum ← 0
    For i ← 2, n execute
        For j ← 1, i execute
            If v[j] < v[i] then
                sum ← sum + 1
            EndIf
        EndFor
    EndFor
    Return sum
EndAlgorithm
```

C.
```
Algorithm litere(v, n):
    sum ← 0
    For i ← 2, n - 1 execute
        For j ← i + 1, n execute
            If v[j] - 'A' < v[i] - 'A' then
                sum ← sum + 1
            EndIf
        EndFor
    EndFor
    Return sum
EndAlgorithm
```

D.
```
Algorithm litere(v, n):
    sum ← 0
    For i ← 1, n execute
        For j ← 1, i execute
            If v[j] < v[i] - 'A' then
                sum ← sum + (v[i] - v[j])
            EndIf
        EndFor
    EndFor
    Return sum
EndAlgorithm
```

BABEŞ-BOLYAI UNIVERSITY

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Admission Exam – September 9th, 2025

Written Exam for Computer Science

GRADING AND SOLUTIONS

DEFAULT: 10 points

1	AC	3.75 points
2	AD	3.75 points
3	CD	3.75 points
4	BCD	3.75 points
5	BD	3.75 points
6	ABC	3.75 points
7	AC	3.75 points
8	AC	3.75 points
9	A	3.75 points
10	BD	3.75 points
11	C	3.75 points
12	ABC	3.75 points
13	D	3.75 points
14	A	3.75 points
15	CD	3.75 points
16	A	3.75 points
17	AC	3.75 points
18	C	3.75 points
19	AD	3.75 points
20	BC	3.75 points
21	A	3.75 points
22	AD	3.75 points
23	B	3.75 points
24	B	3.75 points