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FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Mate-Info Contest – April 20th 2024

Written test in 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 consists of elements occupying consecutive positions in the array.
- If on the same row there are several consecutive assignment statements, they are separated by "; ".

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

```
Algorithm calcul(v, n):
    i ← 1; j ← n
    While i < j execute
        While i < j AND v[i] MOD 2 = 1 execute
            i ← i + 1
        EndWhile
        While i < j AND v[j] MOD 2 = 1 execute
            j ← j - 1
        EndWhile
        If v[i] ≠ v[j] then
            Return False
        EndIf
        i ← i + 1
        j ← j - 1
    EndWhile
    Return True
EndAlgorithm
```

In which of the following situations does the algorithm return *True*?

A. If array v consists of the values [1, 11, 2, 4, 3, 4, 7, 6, 4, 21, 23, 25, 2] and $n = 13$.
B. If array v consists of the values [1, 11, 2, 4, 3, 7, 6, 4, 21, 23, 25, 2] and $n = 12$.
C. If and only if the absolute value of the difference between two even elements of array v between which there is at least one odd element is equal to 2.
D. If the array formed by the even elements of array v when traversed from left to right is equal to the array formed by the even elements of array v when traversed from right to left.

2. Consider the algorithm `g(a, b)`, where a and b are natural numbers ($0 \leq a, b \leq 10^4$):

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

Which of the following statements are true?

A. For the call `g(2, 2)` the algorithm returns 2.
B. If $a = b$, the algorithm never calls itself.
C. If $a = 0$ and $0 \leq b \leq 10^4$, the algorithm calls itself exactly once.
D. If $a \neq 0$, $b \neq 0$ and $a \neq b$, the algorithm calls itself $a + b - 1$ times.

3. A directed graph has 8 vertices, numbered from 1 to 8, and arcs (1, 7), (1, 8), (3, 5), (3, 7), (4, 3), (4, 7), (6, 3), (6, 5), (6, 7), (6, 8), (8, 5), (8, 7). The number of vertices that have zero external degree is:

A. 1 B. 2 C. 3 D. 4

4. What is the value of the expression `NOT ((x MOD 2 = 0) AND (NOT ((y > x) AND (x MOD 7 ≠ 5))))` if $x = 12$ and $y = 23$?

A. *True*
B. *False*
C. Same value as the expression `NOT ((x MOD 2 = 0) AND (NOT ((x > y) AND (x MOD 7 ≠ 5))))`
D. Same value as the expression `NOT ((y MOD 2 = 0) AND (NOT ((x > y) AND (y MOD 7 ≠ 5))))`

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

```
Algorithm ghici(n):
    f ← 0
    y ← -1
    For c ← 0, 9 execute
        x ← n
        k ← 0
        While x > 0 execute
            If x MOD 10 = c then
                k ← k + 1
            EndIf
            x ← x DIV 10
            If k > f then
                f ← k
                y ← c
            EndIf
        EndWhile
    EndFor
    Return y
EndAlgorithm
```

State what the algorithm returns:

A. The number of digits of number ***n***
B. The maximum frequency of the digit frequencies of number **n**
C. One of the digits with the maximum frequency in the number ***n***
D. One of the digits with the maximum value in the number ***n***

6. Consider the algorithm `divizori(n)`, where ***n*** is an integer ($-10^3 \leq n \leq 10^3$).

```
Algorithm divizori(n):
    nr ← 0; d ← 1
    While d * d ≤ n execute
        If n MOD d = 0 then
            nr ← nr + 1
        EndIf
        d ← d + 1
    EndWhile
    Return 2 * nr
EndAlgorithm
```

Which of the following statements are true?

A. If ***n*** = 5, the algorithm returns 2.
B. If ***n*** > 1, the algorithm returns the number of all divisors (proper and improper) of the number ***n***.
C. If ***n*** = 0, the algorithm returns 0.
D. If ***n*** < 0, the algorithm returns the number of all divisors (proper and improper) of the absolute value of ***n***.

7. Consider the algorithm `ceReturneaza(a, b)`, where ***a*** and ***b*** are natural numbers ($0 \leq a, b \leq 10^3$):

```
Algorithm ceReturneaza(a, b):
    If a > b then
        c ← a; a ← b; b ← c
    EndIf
    d ← 0
    For i ← a, b execute
        If i MOD 2 = 0 then
            d ← d + 1
        EndIf
    EndFor
    Return d
EndAlgorithm
```

In which of the following situations is the returned result 0?

A. ***a*** = 11, ***b*** = 11
B. ***a*** = 4, ***b*** = 8
C. ***a*** = 12, ***b*** = 12
D. ***a*** = 0, ***b*** = 0

8. Consider the algorithm `ceFace(n)`, where ***n*** is a natural number ($1 \leq n \leq 10^4$):

```
Algorithm ceFace(n):
    k ← 0
    s ← 0
    While k ≠ n execute
       k ← k + 1
       s ← s + 2 * k - 1
       Write s, " "
    EndWhile
EndAlgorithm
```

Which of the following statements are true?

A. For ***n*** = 3, the algorithm will display: `0 9`
B. For ***n*** = 10, the penultimate value assigned to variable ***s*** during execution is `81`
C. The algorithm displays the squares of natural numbers 1, 2, ..., ***n***
D. For ***n*** = 4, the algorithm will display: `1 4 8 16`

9. Consider the algorithms `verificare_aux(a, b)` and `verificare(a, b)`, where ***a*** and ***b*** are natural numbers ($1 \leq a, b \leq 10^9$):

```
Algorithm verificare_aux(a, b):
    c ← b
    While a > 0 execute
        While (c > 0) AND (a MOD 10 ≠ c MOD 10) execute
            c ← c DIV 10
        EndWhile
        If c = 0 then
            Return False
        EndIf
        c ← b
        a ← a DIV 10
    EndWhile
    Return True
EndAlgorithm
```

```
Algorithm verificare(a, b):
    Return verificare_aux(a, b) AND verificare_aux(b, a)
EndAlgorithm
```

For which of the following conditions will the algorithm `verificare(a, b)` return *True*?

A. If ***a*** and ***b*** have the same number of digits.
B. If ***a*** = 1001 and ***b*** = 10.
C. If the frequency array of ***a***'s digits is identical to the frequency array of ***b***'s digits.
D. If ***a*** = 123 and ***b*** = 321.

10. Consider the algorithm `verifica(n)`, where ***n*** is a natural number ($1 \leq n \leq 10^4$).

```
Algorithm verifica(n):
    a ← n MOD 10
    n ← n DIV 10
    While n > 0 execute
        b ← n MOD 10
        If a ≤ b then
            Return False
        EndIf
        a ← b
        n ← n DIV 10
    EndWhile
    Return True
EndAlgorithm
```

Which of the following statements are true?

A. The call `verifica(2024)` returns *False*.
B. The algorithm returns *True* if and only if ***n*** is a number in which the digits are in strictly ascending order.
C. The algorithm returns *True* if and only if ***n*** is a number in which the digits are in strictly descending order.
D. The algorithm returns *True* if and only if the most significant digit of ***n*** is smaller than its most insignificant digit.

11. Consider the algorithm `F(x, n, i, S, k)`, where ***x*** is an array of ***n*** ($1 \leq n \leq 10^4$) integers (***x***[1], ***x***[2], ..., ***x***[***n***], $-10^3 \leq x[i] \leq 10^3$ for ***i*** = 1, 2, ..., ***n***), ***S*** is a real number, and ***i*** and ***k*** are natural numbers. The "/" operator represents the real division, for example: 3 / 2 = 1.5.

```
Algorithm F(x, n, i, S, k):
    If n < i then
        If k = n then
            Return 0
        Else
            Return S / (n - k)
        EndIf
    Else
        If x[i] MOD 2 = 0 then
            Return F(x, n, i + 1, S + x[i], k)
        Else
            Return F(x, n, i + 1, S, k + 1)
        EndIf
    EndIf
EndAlgorithm
```

Given the algorithm call `F(x, n, 1, 0.0, 0)`, state which of the following statements are true?

A. The algorithm returns the sum of the even numbers in array ***x***, divided by the number of odd numbers in the array.
B. If ***n*** = 10 and ***x*** = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10], the algorithm returns the value 6.0.
C. The algorithm returns the arithmetic mean of the even numbers in array ***x***.
D. If ***n*** = 10 and ***x*** = [1, 3, 5, 7, 9, 11, 13, 15, 17, 19], the algorithm returns the value 0.

12. Consider a square matrix ***x*** of dimension ***n*** with elements distinct natural numbers ($2 \leq n \leq 50$, ***x***[1][1], ..., ***x***[1][***n***], ***x***[2][1], ..., ***x***[2][***n***], ..., ***x***[***n***][1], ..., ***x***[***n***][***n***], $1 \leq x[i][j] \leq 10^4$, for ***i*** = 1, 2, ..., ***n***, ***j*** = 1, 2, ..., ***n***). The elements of each row and the elements of each column are ordered ascendingly. The algorithm `cauta(n, x, v)` searches for a value ***v*** in matrix ***x*** and returns the pair formed by the row index and column index of the position on which the value ***v*** is located in the matrix, or (-1, -1) if the value ***v*** is not among the elements of the matrix. Assume that the `cautareBinara(t, n, v)` algorithm implements the binary search algorithm to determine whether a number ***v*** is present in array ***t*** consisting of ***n*** elements ordered ascendingly. If ***v*** is not in the i^{th} row of the matrix, the call `cautareBinara(x[i], n, v)` returns -1.

Which of the following algorithms are the most time complexity efficient and accomplish the described requirements?

A.

```
Algorithm cauta(n, x, v):
    a ← -1
    b ← -1
    For i ← 1, n execute
        For j ← 1, n execute
            If x[i][j] = v then
                a ← i
                b ← j
            EndIf
        EndFor
    EndFor
    Return a, b
EndAlgorithm
```

B.

```
Algorithm cauta(n, x, v):
    a ← -1
    b ← -1
    For i ← 1, n execute
        j ← cautareBinara(x[i], n, v)
        If j ≠ -1 then
            a ← i
            b ← j
        EndIf
    EndFor
    Return a, b
EndAlgorithm
```

C.

```
Algorithm cauta(n, x, v):
    a ← -1
    b ← -1
    i ← 1; j ← n
    While i ≤ n AND j > 0 execute
        If x[i][j] = v then
            a ← i
            b ← j
        EndIf
        If x[i][j] > v then
            j ← j - 1
        Else
            i ← i + 1
        EndIf
    EndWhile
    Return a, b
EndAlgorithm
```

D.

```
Algorithm cauta(n, x, v):
    a ← -1
    b ← -1
    i ← 1; j ← 1
    While i ≤ n AND x[i][j] < v execute
        i ← i + 1
    EndWhile
    While j ≤ n AND x[i][j] < v execute
        j ← j + 1
    EndWhile
    If x[i][j] = v then
        a ← i
        b ← j
    EndIf
    Return a, b
EndAlgorithm
```

13. Given a square matrix ***M*** of 3 × 3 elements, which of the following code sequences correctly implement a 90-degree counterclockwise rotation of the matrix around the element at position (2, 2)?

A.

```
For i ← 0, 1 execute
    X ← M[1][1]
    M[1][1] ← M[1][2]
    M[1][2] ← M[1][3]
    M[1][3] ← M[2][3]
    M[2][3] ← M[3][3]
    M[3][3] ← M[3][2]
    M[3][2] ← M[3][1]
    M[3][1] ← M[2][1]
    M[2][1] ← X
EndFor
```

B.

```
For i ← 0, 2 execute
    X ← M[1][1]
    M[1][1] ← M[1][2]
    M[1][2] ← M[1][3]
    M[1][3] ← M[2][3]
    M[2][3] ← M[3][3]
    M[3][3] ← M[3][2]
    M[3][2] ← M[3][1]
    M[3][1] ← M[2][1]
    M[2][1] ← X
EndFor
```

C.

```
For i ← 1, 2 execute
    X ← M[1][1]
    M[1][1] ← M[1][2]
    M[1][2] ← M[1][3]
    M[1][3] ← M[2][3]
    M[2][3] ← M[3][3]
    M[3][3] ← M[3][2]
    M[3][2] ← M[3][1]
    M[3][1] ← M[2][1]
    M[2][1] ← X
EndFor
```

D.

```
For i ← 1, 3 execute
    X ← M[1][1]
    M[1][1] ← M[1][i]
    M[1][i] ← M[1][3]
    M[1][3] ← M[i][3]
    M[i][3] ← M[3][3]
    M[3][3] ← M[3][i]
    M[3][i] ← M[3][1]
    M[3][1] ← M[i][1]
    M[i][1] ← X
EndFor
```

14. Consider the algorithm `rearanjeaza(x, n)`, where n is a natural number ($1 \leq n \leq 200$), and x is an array of n distinct integer numbers ($x[1], x[2], ..., x[n], -100 \leq x[i] \leq 100$, for $i = 1, 2, ..., n$). The algorithm `interschimba(x, i, j)` swaps elements $x[i]$ and $x[j]$.

```
Algorithm rearanjeaza(x, n):
    v ← x[n]
    i ← 0; j ← 1
    While j ≤ n – 1 execute
        If x[j] ≤ v then
            i ← i + 1
            interschimba(x, i, j)
        EndIf
        j ← j + 1
    EndWhile
    i ← i + 1
    interschimba(x, i, n)
    Return i
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm sorts the elements of array x in ascending order.
B. If array x is sorted in ascending order, the order of its elements will not change.
C. Array x will be rearranged such that the last element of the initial array will have only elements with a lower value to its left and only elements with a greater value to its right.
D. The algorithm returns the initial index of the element with the minimum value in array x.

15. Consider the algorithm `calcul(v, n)`, where n is a natural number ($1 \leq n \leq 10^4$), and v is an array containing n natural number elements ($v[1], v[2], ..., v[n], 1 \leq v[i] \leq 200$, for $i = 1, 2, ..., n$):

```
Algorithm calcul(v, n):
    If n = 1 then
        Return v[1]
    EndIf
    If v[1] MOD v[n] = 0 then
        v[1] ← v[n]
        n ← n - 1
        Return calcul(v, n)
    Else
        aux ← v[n]
        v[n] ← v[1] MOD v[n]
        v[1] ← aux
        Return calcul(v, n)
    EndIf
EndAlgorithm
```

For which of the following parameters will the algorithm return the value 12?

A. $v = [60, 96, 120, 84]$, $n = 4$
B. $v = [75, 24, 12, 84]$, $n = 4$
C. $v = [75, 24, 49, 80]$, $n = 4$
D. $v = [60, 24, 12, 84]$, $n = 4$

16. Consider the algorithm `ceFace(n)`, where n is an integer number ($-10^4 \leq n \leq 10^4$):

```
Algorithm ceFace(n):
    If n = 0 then
        Return "0"
    EndIf
    If n < 0 then
        Return "-" + ceFace(-n)
    EndIf
    If n MOD 3 = 0 then
        Return ceFace(n DIV 3) + "0"
    EndIf
    If n MOD 3 = 1 then
        Return ceFace(n DIV 3) + "1"
    EndIf
    Return ceFace(n DIV 3) + "2"
EndAlgorithm
```

Which of the following statements are true?

A. If number n is a power of 3, the returned string contains exactly one character `"1"`.
B. For $n = 3$ and $n = -3$ the algorithm `ceFace(n)` returns identical values.
C. If $n = 82$, the algorithm returns `"010001"`.
D. If n is a negative number, the algorithm enters an infinite loop.

17. Consider the algorithm `decide(n, x)`, where n is a natural number ($1 \leq n \leq 10^4$), and x is an array with n natural number elements ($x[1], x[2], ..., x[n], 0 \leq x[i] \leq 100$, for $i = 1, 2, ..., n$).

Which of the following statements are true?

A. If $n = 5$ and $x = [1, 2, 1, 3, 1]$ the algorithm returns 1.
B. If $n = 5$ and $x = [1, 2, 2, 3, 1]$ the algorithm returns -1.
C. The algorithm returns -1 for any input array.
D. The algorithm returns the first element of array x.

```
Algorithm decide(n, x):
    a ← x[1]
    i ← 2; j ← 1
    While i ≤ n execute
        If x[i] = a then
            j ← j + 1
        Else
            If j > 0 then
                j ← j - 1
            Else
                a ← x[i]
                j ← 1
            EndIf
        EndIf
        i ← i + 1
    EndWhile
    i ← 1; j ← 0
    While i ≤ n execute
        If x[i] = a then
            j ← j + 1
        EndIf
        i ← i + 1
    EndWhile
    If j > (n DIV 2) then
        Return a
    Else
        Return -1
    EndIf
EndAlgorithm
```

18. Consider the algorithm `ceFace(n)`, within which n numbers will be read, where n is a natural number ($1 \leq n \leq 10^9$):

```
Algorithm ceFace(n):
    nr ← 0
    Read a
    For i ← 2, n execute
        Read b
        If a ≠ b then
            nr ← nr + 1
        EndIf
        a ← b
    EndFor
    Return nr
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm returns the number of numbers repeated among the numbers read (for example, if the numbers are 3, 34, 34, 7, 3, 34 then the returned value is 2).
B. The algorithm returns the length of the longest subarray with equal values among the numbers read (for example, if the numbers are 2, 34, 34, 34, 5 then the returned value is 3).
C. The algorithm returns the number of pairs of consecutive elements with different values among the numbers read (for example, if the numbers are 2, 34, 34, 7, then (2, 34), (34, 7) are pairs of consecutive elements with different values and the returned value is 2).
D. The algorithm returns the number of pairs of consecutive elements with equal values among the numbers read (for example, if the numbers are 2, 2, 3, 3, then (2, 2), (3, 3) are pairs of consecutive elements with equal values and the returned value is 2).

19. Consider the algorithm `f(a)`, where a is a natural number ($0 \leq a \leq 10^4$):

```
Algorithm f(a):
    n ← 0
    While a > 1 execute
        b ← 1
        While b ≤ a execute
            b ← 3 * b
            n ← n + 1
        EndWhile
        a ← a DIV 3
    EndWhile
    Return n
EndAlgorithm
```

What is the value returned by the algorithm if it is called for $a = 81$?

A. 0
B. 14
C. 16
D. 9

20. Consider the algorithm `h(n, a)`, where n is a natural number ($1 \leq n \leq 10^3$), and a is an array with n integer number elements ($a[1], a[2], ..., a[n], -10^4 \leq a[i] \leq 10^4$, for $i = 1, 2, ..., n$) sorted in ascending order.

Which of the following calls will return the value 4?

A. `h(5, [1, 2, 3, 4, 5])`
B. `h(6, [2, 4, 6, 10, 18, 20])`
C. `h(7, [2, 2, 3, 4, 6, 9, 13])`
D. `h(5, [2, 2, 2, 4, 6])`

```
Algorithm h(n, a):
    t ← 0; i ← n
    While i > 2 execute
        k ← 1
        j ← i – 1
        b ← a[i]
        While k < j execute
            If a[k] + a[j] = b then
                t ← t + 1
                k ← k + 1
                j ← j - 1
            Else
                If a[k] + a[j] < b then
                    k ← k + 1
                Else
                    j ← j - 1
                EndIf
            EndIf
        EndWhile
        i ← i – 1
    EndWhile
    Return t
EndAlgorithm
```

21. Consider the algorithm `f(x, n, m)` where n and m are natural numbers ($1 \leq n, m \leq 10^4$), and x is an array with n natural numbers ($x[1], x[2], ..., x[n], 1 \leq x[i] \leq 10^4$, for $i = 1, 2, ..., n$):

What value will be returned by the algorithm, if the call is `f(x, 9, 41)`, where x = [41, 15, 5, 8, 10, 1, 16, 18, 19]?

A. 1 B. 3 C. 5 D. 7

```
Algorithm f(x, n, m):
    If m = 0 then
        Return 1
    EndIf
    If n = 0 then
        Return 0
    EndIf
    If x[n] > m then
        Return f(x, n - 1, m)
    Else
        Return f(x, n - 1, m) + f(x, n - 1, m – x[n])
    EndIf
EndAlgorithm
```

22. Consider the algorithm `select(v, x, n)`, where n is a natural number ($1 \leq n \leq 10^4$), v is an array with n integer number elements ($v[1], v[2], ..., v[n], -100 \leq v[i] \leq 100$, for $i = 1, 2, ..., n$), and x is an integer number, $-100 \leq x \leq 100$:

```
Algorithm select(v, x, n):
    i ← 1; j ← n
    While i ≤ j execute
        k ← (i + j) DIV 2
        If v[k] = x then
            Return k
        EndIf
        If v[i] ≤ v[k] then
            If v[i] ≤ x AND x < v[k] then
                j ← k - 1
            Else
                i ← k + 1
            EndIf
        Else
            If v[k] < x AND x ≤ v[j] then
                i ← k + 1
            Else
                j ← k - 1
            EndIf
        EndIf
    EndWhile
    Return -1
EndAlgorithm
```

Which of the following statements are true?

A. In the case of the call `select([0, 1, 2, 4, 5, 8, 9, 10, 7, 6], 10, 10)`, the algorithm returns 10.
B. The algorithm returns the position on which the element x appears in array v if and only if array v is sorted in ascending order.
C. The complexity of the algorithm is $O(\log_2 n)$.
D. In the case of the call `select([0, 1, 2, 4, 5, 8, 9, 10, 7, 6], 7, 10)`, the algorithm returns -1.

23. Consider the algorithm `maiMare(n)` where ***n*** is a non-zero natural number ($1 \leq n < 10^6$) with no repeating digits. The algorithm should return the number of numbers that are strictly greater than ***n***, formed using the digits of ***n***. For example, `maiMare(213) = 3`. We assume that ***n*** does not have leading zeros and we have the following algorithms implemented according to the specifications:

- `factorial(n)` – returns the factorial of the natural number ***n*** ($1 \leq n \leq 10$)
- `nrCifre(n)` – returns the number of digits of the natural number ***n*** ($1 \leq n < 10^6$)
- `imparte(n)` – returns an array containing the digits of the natural number ***n*** ($1 \leq n < 10^6$), in reverse order. For example: `imparte(1352)` returns the array `[2, 5, 3, 1]`.

```
Algorithm maiMare(n):
    cifre ← imparte(n)
    nrCif ← nrCifre(n)
    Return calculeaza(cifre, nrCif)
EndAlgorithm
```

```
1.  Algorithm calculeaza(v, n):
2.      If n < 2 then
3.          Return 0
4.      EndIf
5.      mm ← 0
6.      For i ← 1, n - 1 execute
7.          If v[i] > v[n] then
8.              mm ← mm + 1
9.          EndIf
10.     EndFor
11.     ...
12. EndAlgorithm
```

Which of the following instructions must be written on line 11 of algorithm `calculeaza(v, n)`?

A. `Return factorial(n) – ((n - mm - 1) * factorial(n - 1) + calculeaza(v, n - 1))`
B. `Return calculeaza(v, n - 1) * mm + factorial(n - 1)`
C. `Return (mm * factorial(n) + calculeaza(v, n - 1)) DIV n`
D. `Return calculeaza(v, n - 1) + mm * factorial(n - 1)`

24. An event should have taken place in hall I, but must be moved to hall II, where the chair numbering is different. In both halls there are ***L*** rows of chairs ($2 \leq L \leq 50$), each row is divided in the middle by an aisle and has ***K*** chairs ($2 \leq K \leq 50$) on each side of the aisle (thus, the hall contains 2 * ***K*** * ***L*** chairs).
In hall II each seat is identified by a single number. The seats on the left of the aisle have even numbers, and the chair numbering starts with the row closest to the stage. So, the chairs from the first row have the numbers 2, 4, 6, etc. (starting from the aisle and moving towards the edge of the hall). After the chairs of a row have been numbered, the numbering continues on the next row with the chair closest to the aisle and the next even number. The seats on the right side of the aisle are numbered in a similar fashion but using odd numbers. So, the chairs in the first row have the numbers 1, 3, 5, etc., starting from the aisle and moving towards the edge of the hall.
In hall I each seat is identified using three values. The number of the row (***rand*** **-** a value between 1 and ***L*** inclusive, row 1 being the one closest to the stage), the direction of the seat with respect to the aisle (***directie*** **-** the value "stanga" or "dreapta") and the chair number within the row (***loc*** **-** a value between 1 and ***K*** inclusive, chair 1 being the one closest to the aisle). Because the event is moved, the seats from the tickets from hall I (represented by ***rand***, ***loc***, ***directie***) must be converted to valid seats for hall II (represented by a single number).

Which of the following algorithms, having as input parameters ***K***, ***rand***, ***loc***, ***directie*** according to the description above, perform the correct conversion between the hall seats (a conversion is correct if each spectator has a unique seat in hall II)?

A.

```
Algorithm transforma(K, rand, loc, directie):
    If directie = "stanga" then
        rez ← 2 * (loc + K * (rand - 1))
    Else
        rez ← 2 * (loc + K * (rand - 1) + 1)
    EndIf
    Return rez
EndAlgorithm
```

B.

```
Algorithm transforma(K, rand, loc, directie):
    rez ← rand * (K – 1) * 2
    rez ← rez + (loc * 2)
    If directie = "dreapta" then
        rez ← rez – 1
    EndIf
    Return rez
EndAlgorithm
```

C.

```
Algorithm transforma(K, rand, loc, directie):
    rez ← (rand - 1) * K * 2
    rez ← rez + (loc * 2)
    If directie = "dreapta" then
        rez ← rez – 1
    EndIf
    Return rez
EndAlgorithm
```

D.

```
Algorithm transforma(K, rand, loc, directie):
    rez ← (rand - 1) * K * 2
    rez ← rez + (loc * 2)
    If directie = "dreapta" then
        rez ← rez + 1
    EndIf
    Return rez
EndAlgorithm
```

BABEŞ-BOLYAI UNIVERSITY

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Mate-Info Contest – April 20th, 2024

Written Exam for Computer Science

GRADING AND SOLUTIONS

DEFAULT: 10 points

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