**BABEŞ-BOLYAI UNIVERSITY**
**FACULTY OF MATHEMATICS AND COMPUTER SCIENCE**

**Admission Exam – July 17th, 2026**
**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 occupying consecutive positions in the array or the string.
- If on the same row there are several consecutive assignment statements, they are separated by "; ".

**1.** Consider the algorithm `ceface(n)`, where $n$ is a natural number ($0 \leq n \leq 10^3$) and the & operation represents bitwise **AND**.

```
Algorithm ceface(n):
    If (n & 1) ≠ 0 then
        Return 0
    EndIf
    Return 1
EndAlgorithm
```

Which of the following statements are true?

A. If $n$ is a power of 2, the algorithm returns 1.
B. If $n$ is an even number, the algorithm returns 1.
C. The algorithm returns 0 if and only if $n$ is an odd number.
D. If $n = 0$, the algorithm returns 0.

**2.** Consider the algorithm `gramana(n, x)`, where $n$ is a natural number ($1 \leq n \leq 10^3$), and $x$ is a string of $n$ characters ($x[1], x[2], ..., x[n]$, for $i = 1, 2, ..., n$), all lowercase letters.

```
Algorithm gramana(n, x):
    For i ← n, 1, -1 execute
        For j ← 2, i execute
            If x[j - 1] > x[j] then
                car ← x[j]
                x[j] ← x[j - 1]
                x[j - 1] ← car
            EndIf
        EndFor
    EndFor
EndAlgorithm
```

Which of the following statements are true?

A. The time complexity of the algorithm is $O(n^2)$.
B. The algorithm performs a circular permutation of the elements from the given string.
C. The algorithm sorts the string $x$ in ascending lexicographical order.
D. The algorithm sorts the string $x$ in descending lexicographical order.

**3.** Given the binary number $101100110000_{(2)}$, specify which of the following statements are true.

A. The number is divisible by $16_{(10)}$
B. The number is smaller than $10000_{(10)}$
C. The number is even.
D. The number is divisible by $32_{(10)}$.

**4.** Consider the algorithm `test(n)`, where $n$ is a natural number ($1 \leq n \leq 10^3$).

```
Algorithm test(n):
    c ← 1
    While n > 0 execute
        n ← n - 2
        c ← c * 2
    EndWhile
    Return c
EndAlgorithm
```

Which of the following statements are true?

A. The value returned by the call `test(n)` is always greater than $n$.
B. The value returned by the call `test(n)` is always smaller than the value returned by the call `test(n + 1)`.
C. If the distinct natural numbers $n$ and $m$ have the same parity, the values returned by the calls `test(n)` and `test(m)` are different.
D. The algorithm `test(n)` has a time complexity of $O(\log n)$.

**5.** Consider the algorithm `mister(x, n)`, where $n$ is a natural number ($1 \leq n \leq 10^3$), and $x$ is an array of $n$ natural numbers ($x[1], x[2], \ldots, x[n]$, $10 \leq x[i] \leq 10^5$, for $i = 1, 2, ..., n$).

```
Algorithm mister(x, n):
    For i ← 1, n – 1 execute
        For j ← i + 1, n execute
            a ← x[i]
            b ← x[j]
            While a > 10 execute
                a ← a DIV 10
            EndWhile
            While b > 10 execute
                b ← b DIV 10
            EndWhile
            If a < b then
                aux ← x[i]
                x[i] ← x[j]
                x[j] ← aux
            EndIf
        EndFor
    EndFor
    Return x
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm `mister(x, n)` sorts the array $x$ in descending order by the first digit of its elements.
B. After the call `mister([345, 21, 98, 412, 67], 5)` the algorithm returns the array `[98, 67, 412, 345, 21]`.
C. The algorithm `mister(x, n)` sorts the array $x$ in ascending order by the last digit of its elements.
D. After the call `mister([10, 305, 47, 89], 4)` the algorithm returns the array `[89, 47, 305, 10]`.

**6.** At a sports tournament there are $n$ ($2 \leq n \leq 100$) players. Each match is played between 2 players; a player that loses a match is eliminated from the tournament.

How many matches must be played to determine the winner of the tournament?

A. $n - 1$ B. $n$ C. $n$ **DIV** 2 D. ($n$ **DIV** 2) + 1

**7.** A logical expression consisting of terms connected with the operator **OR** ($t_1$ **OR** $t_2$ **OR ... OR** $t_n$) is evaluated from left to right until the first term with the value *True* is found, if such a term exists (in which case the value of the expression is *True* and the other terms are not evaluated). Otherwise, if all terms are evaluated as *False*, the value of the expression will also be *False*.

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

```
Algorithm test(n):
    Write '*'
    If n < 10 then
        Return False
    EndIf
    If n MOD 2 = 0 then
        Return True
    EndIf
    If n MOD 5 = 0 then
        Return True
    EndIf
    Return test(n DIV 2) OR test(n DIV 5) OR test(n DIV 10) //#
EndAlgorithm
```

Assuming that at the line marked with #, where there is a logical expression of three terms connected with the **OR** operator, the evaluation described above takes place, how many `'*'` characters will be displayed after the call `test(159)`?

A. 10 B. 15
C. 3 D. 8

**8.** Consider the algorithm `f(n)`, where $n$ is a natural number ($1 \leq n \leq 10^3$).

```
Algorithm f(n):
    If n = 1 then
        Return 0
    EndIf
    Return f(n DIV 2) + 1
EndAlgorithm
```

What will be returned after the call `f(n)`?

A. The integer part of $\log_2 n$.
B. The minimal number of bits required to represent the number $n$ in base 2.
C. The number of bits equal to 1 from the base 2 representation of number $n$.
D. A value that is different from $n$.

**9.** Consider the algorithm `ff(n, v)`, where $n$ is a natural number ($1 \leq n \leq 10^4$), and $v$ is an array of $n$ integer numbers ($v[1], v[2], ..., v[n]$, $-100 \leq v[i] \leq 100$, for $i = 1, 2, ..., n$).

```
Algorithm ff(n, v):
    c ← 0
    For j ← 2, n execute
        a ← v[j]
        i ← j - 1
        While i > 0 AND v[i] ≥ a execute
            v[i + 1] ← v[i]
            i ← i – 1
            c ← c + 1
        EndWhile
        v[i + 1] ← a
    EndFor
    Return c
EndAlgorithm
```

What value is returned after the call `ff(5, [-4, 1, 7, -8, 1])`?

A. 4
B. 2
C. 5
D. 8

**10.** Consider the algorithm `f(a, b)`, where $a$ and $b$ are natural numbers ($1 \leq a, b \leq 10^5$).

```
Algorithm f(a, b):
    If b = 0 then
        Return 0
    EndIf
    If b MOD 2 = 0 then
        Return f(a + a, b DIV 2)
    Else
        Return f(a + a, b DIV 2) + a
    EndIf
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm returns the value $a * b$.
B. The time complexity of the algorithm is $O(\log b)$.
C. After the call `f(2, 3)`, the algorithm returns 8.
D. The algorithm returns the value $a^b$.

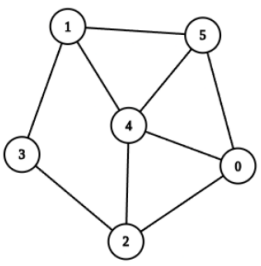
**11.** Consider the algorithm `ceFace(a, n, s)`, where $a$ is an array of $n$ ($1 \leq n \leq 20$) natural numbers ($a[1], a[2], \ldots, a[n]$, $0 \leq a[i] \leq 10^3$ for $1 \leq i \leq n$) sorted in ascending order, and $s$ is a natural number ($0 \leq s \leq 10^3$).

```
Algorithm ceFace(a, n, s):
    c ← 0
    For i ← 1, n – 2 execute
        j ← i + 1
        k ← n
        While j < k execute
            sum ← a[i] + a[j] + a[k]
            If sum = s then
                c ← c + 1
                j ← j + 1
                k ← k - 1
            Else
                If sum < s then
                    j ← j + 1
                Else
                    k ← k - 1
                EndIf
            EndIf
        EndWhile
    EndFor
    Return c
EndAlgorithm
```

After which of the following calls will the value 3 be returned?

A. `ceFace([1, 2, 3, 4, 5, 6], 6, 10)`
B. `ceFace([1, 2, 3, 4, 4, 5, 6], 7, 10)`
C. `ceFace([1, 2, 3, 4, 4, 5, 6], 7, 8)`
D. `ceFace([1, 1, 1, 2, 2, 2], 6, 4)`

**12.** Consider the following graph:




Which of the following node sequences is a Hamiltonian cycle?

A. `0 1 2 3 4 5 0`
B. `1 3 2 0 4 5 1`
C. `1 3 2 4 2 0 5`
D. `4 2 3 1 5 0 4`

**13.** Prâslea the Brave has a magical tree with 27 golden apples and 24 silver apples. Every day, an ogre steals 2 apples, however, at the same time, the tree grows a new apple: if the 2 stolen apples are of the same kind (both golden or both silver) the tree grows a silver apple, and if the ogre steals a golden apple and a silver apple, the tree grows a golden apple.

Which of the following statements are true?

A. On the 50th day, the ogre steals a golden apple and a silver apple.
B. We cannot establish what kind of apples the ogre steals on the 50th day.
C. There exists a succession of thefts such that, at a given moment, the tree has only silver apples.
D. Over the course of the described process, the total number of apples in the tree decreases by exactly one each day.

**14.** Consider the algorithm `f(X, n, k)`, where ***n*** and ***k*** are natural numbers ($1 \leq k \leq n \leq 10$), and ***X*** is an array of ***n*** natural numbers (***X***[1], ***X***[2], ..., ***X***[***n***]).

```
Algorithm f(X, n, k):
    If k = n + 1 then
        aux ← 0; ok ← True
        For j ← 1, n execute
            If X[j] = 1 then
                aux ← aux + 1
            EndIf
            If j > 1 AND X[j] = 1 AND X[j - 1] = 1 then
                ok ← False
            EndIf
        EndFor
        If ok AND aux = n DIV 2 then
            For j ← 1, n execute
                Write X[j]
            EndFor
            Write New Line
        EndIf
    Else
        For i ← 0, 1 execute
            X[k] ← i
            f(X, n, k + 1)
        EndFor
    EndIf
EndAlgorithm
```

After the call `f([0, 0, 0, 0], 4, 1)` the first displayed line is `0101`. What will be displayed on the next two lines?

A.
```
1001
1100
```
B.
```
1010
0110
```
C.
```
0110
1010
```
D.
```
1001
1010
```

**15.** Consider the algorithm `LU(A, n)`, where ***A*** is a square matrix of size ***n*** (***A***[1][1], ***A***[1][2], ..., ***A***[1][***n***], ..., ***A***[***n***][***n***], $0 < A[i][j] < 10^3$, for $i, j = 1, ..., n$) that contains natural numbers, and ***n*** is a natural number ($2 \leq n \leq 10$). The algorithm `zerosMat(n)` returns a square matrix of size ***n*** having all elements equal to 0.

```
Algorithm LU(A, n):
    L ← zerosMat(n); U ← zerosMat(n)
    For i ← 1, n execute
        L[i][i] ← 1
        For j ← i, n execute
            sum ← 0
            For k ← 1, i - 1 execute
                sum ← sum + L[i][k] * U[k][j]
            EndFor
            U[i][j] ← A[i][j] - sum
        EndFor
        For j ← i + 1, n execute
            sum ← 0
            For k ← 1, i - 1 execute
                sum ← sum + L[j][k] * U[k][i]
            EndFor
            L[j][i] ← (A[j][i] - sum) DIV U[i][i]
        EndFor
    EndFor
    Return L, U
EndAlgorithm
```

Which of the following statements are true?

A. After the call `LU(A, n)`, matrix ***L*** will have all the elements above the main diagonal equal to 0.
B. The time complexity of the algorithm is $O(n^2)$
C. If $A = \begin{pmatrix} 2 & 1 & 2 \\ 4 & 6 & 3 \\ 4 & 2 & 8 \end{pmatrix}$ and $n = 3$, after the call `LU(A, n)` the values of the returned matrices ***L*** and ***U*** will be $L = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 2 & 0 & 1 \end{pmatrix}$ and $U = \begin{pmatrix} 2 & 1 & 2 \\ 0 & 4 & -1 \\ 0 & 0 & 4 \end{pmatrix}$.
D. After the call `LU(`$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$`, 2)`, the product of the elements from the main diagonal of matrix ***U*** is equal to the determinant of matrix ***A***.

**16.** Consider the algorithm `f(x, y, v)`, where $x$, $y$ and $v$ are natural numbers ($1 \leq x, y, v \leq 100$, $x \leq v$).

```
Algorithm f(x, y, v):
    If x ≥ v then
        Write '1'
    Else
        If x MOD y ≠ 0 then
            f(x + 1, y, v - 1)
        Else
            If y MOD v ≠ 0 then
                f(x, y + 1, v - 1)
                Write '*'
            Else
                f(x + 1, y, v - 2)
                Write '2'
            EndIf
        EndIf
    EndIf
EndAlgorithm
```

Which of the following statements are true?

A. The calls `f(3, 5, 10)`, `f(5, 6, 10)` and `f(2, 5, 9)` display the same result.
B. The call `f(2, 2, 15)` displays `"1*****"`
C. The call `f(2, 3, 14)` displays a result that contains the digit 2.
D. The calls `f(2, 2, 11)`, `f(1, 2, 9)` and `f(3, 7, 9)` display the same result.

**17.** 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):
    If x[n] - x[n - 1] ≠ x[n - 2] then
        Return 0
    EndIf
    k ← 3
    For i ← n - 1, 3, -1 execute
        If x[i] - x[i - 1] ≠ x[i - 2] then
            Return k
        EndIf
        k ← k + 1
    EndFor
    Return k
EndAlgorithm
```

Which of the following statements are true?

A. The call `f(4, [1, 1, 2, 3])` returns 4.
B. The algorithm returns the value $n$, if and only if the values of array $x$ are part of a Fibonacci sequence.
C. There is no array of 3 elements for which the algorithm returns the value 1.
D. If the algorithm returns the value $n$, then the elements of array $x$ are sorted in ascending order.

**18.** Consider the algorithm `verifica(s1, n1, s2, n2)`, where $s1$ and $s2$ are strings containing only lowercase letters of the English alphabet, with lengths $n1$, respectively $n2$ ($1 \leq n1, n2 \leq 100$). The algorithm `zerosVec(n)` returns an array of $n$ natural numbers, all equal to 0.

```
Algorithm verifica(s1, n1, s2, n2):
    If n1 ≠ n2 then
        Return False
    EndIf
    f ← zerosVec(26)
    For i ← 1, n1 execute
        p ← s1[i] - 'a' + 1
        f[p] ← f[p] + 1
    EndFor
    For i ← 1, n2 execute
        p ← s2[i] - 'a' + 1
        ...
        If f[p] < 0 then
            Return False
        EndIf
    EndFor
    Return True
EndAlgorithm
```

Which of the following statements can replace the ellipsis such that the algorithm `verifica(s1, n1, s2, n2)` returns *True* if and only if string $s2$ can be obtained by rearranging the characters of string $s1$?

A. `f[p] ← f[p] - 1`
B. `f[p] ← f[p] + 1`
C. `f[p] ← f[p] - i`
D. `f[p] ← (f[p] + 1) MOD 2`

**19.** Consider the algorithm `produs_str(n1, n2)`, where ***n*1** and ***n*2** are strings that represent non-zero natural numbers (ex. ***n*1** = `"123"` represents the number 123). The algorithm returns the product of the two numbers, as a string. For example, `produs_str("2", "3")` returns `"6"`, and `produs_str("123", "456")` returns `"56088"`.
The algorithm `len(sir)` returns the length of the string ***sir***. The algorithm `int(car)` returns the digit corresponding to the character ***car***. The algorithm `str(nr)` returns the string corresponding to the number ***nr*** (ex. `str(123)` returns `"123"`). The algorithm `add(n, m)` returns the sum of numbers ***n*** and ***m***, represented as strings (ex. `add("123", "457")` returns the number 580). The algorithm `zero(k)` returns an array of ***k*** numbers, all equal to zero. For strings, the `+` operator represents the concatenation operation.

Which of the following variants represent correct implementations of the algorithm `produs_str(n1, n2)`?

A.
```
Algorithm produs_str(n1, n2):
    rez ← ""
    For i ← 1, len(n1) execute
        For j ← 1, len(n2) execute
            produs ← int(n1[i]) * int(n2[j])
            rez ← rez + str(produs)
        EndFor
    EndFor
    Return rez
EndAlgorithm
```

B.
```
Algorithm produs_str(n1, n2):
    rez ← "0"
    For i ← len(n1), 1, -1 execute
        cif ← int(n1[i])
        For j ← 1, cif execute
            rez ← str(add(rez, n2))
        EndFor
    EndFor
    Return rez
EndAlgorithm
```

C.
```
Algorithm produs_str(n1, n2):
    rez ← zero(len(n1) + len(n2))
    For i ← len(n1), 1, -1 execute
        For j ← len(n2), 1, -1 execute
            produs ← int(n1[i]) * int(n2[j])
            poz1 ← i + j - 1
            poz2 ← i + j
            sum ← produs + rez[poz2]
            rez[poz2] ← sum MOD 10
            rez[poz1] ← rez[poz1] + (sum DIV 10)
        EndFor
    EndFor
    rez_str ← ""
    For i ← 1, len(n1) + len(n2) execute
        digit ← rez[i]
        If NOT ((len(rez_str) = 0) AND (digit = 0))
                                                then
            rez_str ← rez_str + str(digit)
        EndIf
    EndFor
    Return rez_str
EndAlgorithm
```

D.
```
Algorithm produs_str(n1, n2):
    rez ← zero(len(n1) + len(n2))
    For i ← len(n1), 1, -1 execute
        cifTransp ← 0
        For j ← len(n2), 1, -1 execute
            produs ← int(n1[i]) * int(n2[j]) +
                            cifTransp + rez[i + j]
            rez[i + j] ← produs MOD 10
            cifTransp ← produs DIV 10
        EndFor
        rez[i] ← rez[i] + cifTransp
    EndFor
    rez_str ← ""
    For i ← 1, len(n1) + len(n2) execute
        digit ← rez[i]
        If NOT ((len(rez_str) = 0) AND (digit = 0))
                                                then
            rez_str ← rez_str + str(digit)
        EndIf
    EndFor
    Return rez_str
EndAlgorithm
```

**20.** Consider the algorithm `P(s, n)`, where ***s*** is a string of length ***n*** ($3 \leq n \leq 255$). Algorithm `copiaza(s, p, q)` returns the subarray of the string ***s*** starting from position ***p*** and ending on position ***q*** ($1 \leq p \leq q \leq n$). The + operator represents the concatenation operation for strings.

```
Algorithm P(s, n):
    i ← n DIV 3
    j ← 2 * (n DIV 3)
    k ← n
    If n MOD 2 = 0 then
        Return copiaza(s, i, i + 1) + copiaza(s, j - 1, j + 1) + copiaza(s, k, k)
    Else
        Return copiaza(s, 1, 1) + copiaza(s, i, i + 1) + copiaza(s, j - 1, j + 1)
    EndIf
EndAlgorithm
```

Which of the following statements are true?

A. The call `P("calculator", 10)` returns `"lcular"`.
B. The string returned by algorithm `P(s, n)` always has fewer than ***n*** characters.
C. The call `P(s1, n1)` can return the string `"ubbubb"`, if and only if ***n*1** is greater or equal to 8, and the call `P(s2, n2)` can return the string `"ubbfmi"`, if and only if ***n*2** is greater or equal to 9.
D. The call `P(s, n)` returns a string containing distinct characters, if and only if ***n*** is greater or equal to 9 and the string ***s*** contains distinct characters.

**21.** Consider the algorithm `f(n, x)`, where ***n*** is a natural number ($1 \leq n \leq 10^3$), ***x*** is an array of ***n*** integer numbers ($x[1], x[2], ..., x[n], -100 \leq x[i] \leq 100$, for $i = 1, 2, ..., n$), and `abs(k)` returns the absolute value of the integer number ***k***.

```
1.    Algorithm f(n, x):
2.        m ← n
3.        a ← 1
4.        b ← -1
5.        For i ← 1, n execute
6.            p ← -1
7.            j ← n
8.            While p = -1 AND j > i execute
9.                If abs(x[i] - x[j]) = 1 then
10.                   p ← j
11.               EndIf
12.               j ← j - 1
13.           EndWhile
14.           t ← i – 1 + n - p
15.           If t < m then
16.               m ← t
17.               a ← i
18.               b ← p
19.           EndIf
20.       EndFor
21.       Return m
22.   EndAlgorithm
```

Which of the following statements are true?

A. After the instruction on line 20 is executed then ***m*** = ***n*** or, if $b \neq -1$, `abs(x[a] - x[b]) = 1`.
B. If array ***x*** contains the first ***n*** ($n \geq 3$) elements of the Fibonacci sequence, regardless of their order in the array, the returned value will be greater than 0.
C. For an array ***x*** with ***n*** elements, and ***y*** an array with the same elements, but permuted circularly to the right with ***k*** positions ($1 \leq k < n$) starting from the initial array ***x***, `f(n, x)` and `f(n, y)` return the same value, regardless of the value of ***k***.
D. The call `f(9, [8, 2, 4, 5, 2, 5, 3, 4, 6])` returns 6.

**22.** Consider the algorithm `f(v, n, i, a, j)`, where ***i***, ***j***, ***n*** and ***a*** are natural numbers ($0 \leq j$, $1 \leq i, n \leq 20$, $1 \leq a \leq 10^4$), ***v*** is an array of ***n*** non-zero natural numbers ($v[1], v[2], ..., v[n]$, $1 \leq v[k] \leq 10^4$, for $k = 1, 2, ..., n$).

```
Algorithm f(v, n, i, a, j):
    If a = 0 AND j MOD 2 = 1 then
        Return 1
    EndIf
    If a = 0 then
        Return 0
    EndIf
    If a < 0 OR i = n + 1 then
        Return 0
    EndIf
    If v[i] MOD 2 = 0 then
        Return f(v, n, i + 1, a, j)
    EndIf
    Return f(v, n, i + 1, a - v[i], j + 1) +
           f(v, n, i + 1, a, j)
EndAlgorithm
```

Which of the following statements are true?

A. The call `f([2, 4, 6], 3, 1, 11, 0)` returns 4.
B. The call `f([1, 7, 11, 2, 3], 5, 2, 11, 0)` returns 2.
C. The call `f(v, n, 1, 1000, 0)` returns 0 regardless of the value of ***n*** and the elements of array ***v***.
D. The call `f([1, 2, 3, 4, 5, 6, 3, 7], 8, 1, 7, 0)` returns 2.

**23.** Consider the algorithm `f(x)`, where $x$ is a natural number ($0 \leq x \leq 10^9$).

```
Algorithm f(x):
    If x = 0 then
        Return 0
    EndIf
    If x MOD 2 = 0 then
        Return f(x DIV 2) + ((x + 1) MOD 2)
    EndIf
    Return f(x DIV 2) - (x MOD 2)
EndAlgorithm
```

```
Algorithm f2(x):
    If x = 0 then
        Return 0
    EndIf
    v ← f2(x DIV 2)
    If x MOD 2 = 0 then
        Return v + ((x + 1) MOD 2)
    EndIf
    Return v - (x MOD 2)
EndAlgorithm
```

Which of the following statements are true?

A. The calls `f(100)` and `f(24)` return the same value.
B. The call `f(1024)` returns the value 10.
C. In the interval [128, 255] there are 36 values for which the algorithm returns 0.
D. The algorithm `f2(x)` returns the same result as algorithm `f(x)` for any number $x$ and has the same time complexity as algorithm `f(x)`.

**24.** Consider the algorithm `nrd(M, r, c, n)`, where $n$ ($2 \leq n \leq 10$), $r$ and $c$ ($1 \leq r, c \leq n$) are natural numbers, and $M$ is a square matrix with $n \times n$ elements ($M[1][1]$, ..., $M[1][n]$, ..., $M[n][1]$, ..., $M[n][n]$, where $M[i][j] \in \{0, 1\}$, for $i, j = 1,..., n$). A path in matrix $M$ represents a succession of neighboring positions on a line or column, all having the value 1, where none of the positions repeat. Two paths are distinct if they differ by at least one position. The 0 values represent "walls" that cannot be passed.

```
Algorithm nrd(M, r, c, n):
    If r = n AND c = n then
        Return 1
    EndIf
    If r < 1 OR r > n OR c < 1 OR c > n OR M[r][c] = 0 then
        Return 0
    EndIf
    total ← 0
    ...
    Return total
EndAlgorithm
```

If we replace the ellipsis with the instructions from the corresponding answer, which of the following statements are true?

A.
```
M[r][c] ← 0
total ← nrd(M, r + 1, c, n) + nrd(M, r - 1, c, n) + nrd(M, r, c + 1, n) + nrd(M, r, c - 1, n)
M[r][c] ← 1
```
The algorithm returns the number of distinct paths from position $M[r][c]$ to position $M[n][n]$ (when the initial algorithm call is made, $M[r][c] = M[n][n] = 1$).

B.
```
M[r][c] ← 0
total ← nrd(M, r + 1, c, n) + nrd(M, r - 1, c, n) + nrd(M, r, c + 1, n) + nrd(M, r, c - 1, n)
M[r][c] ← 1
```
The time complexity of the algorithm is $O(n^4)$.

C.
```
total ← nrd(M, r + 1, c, n) + nrd(M, r - 1, c, n) + nrd(M, r, c + 1, n) + nrd(M, r, c - 1, n)
```
The algorithm returns the number of distinct paths from position $M[r][c]$ to position $M[n][n]$ (when the initial algorithm call is made, $M[r][c] = M[n][n] = 1$).

D.
```
total ← nrd(M, r + 1, c, n) + nrd(M, r, c + 1, n)
```
After the call `nrd(M, 1, 1, 3)`, where matrix $M$ contains only values of 1, the algorithm returns 6.

BABEŞ-BOLYAI UNIVERSITY

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Admission Exam – July 17th, 2026

Written Exam for Computer Science

GRADING AND SOLUTIONS

**DEFAULT**: 10 points

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