BABEŞ-BOLYAI UNIVERSITY
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Mate-Info Contest – March 2022
Written test in Computer Science

IMPORTANT NOTE:
In the absence of further specification, assume that all arithmetic operations are performed on unlimited data types (no overflow/underflow).
Also, index numbering of all arrays starts at 1.

1. Let us consider the algorithm `magic(x)`, where x is a natural number ($1 \leq x \leq 32000$).

```
Algorithm magic(x):
    st ← 1
    dr ← x
    While st ≤ dr execute
        mj ← (st + dr) DIV 2
        If mj * mj = x then
            return True
        EndIf
        If mj * mj < x then
            st ← mj + 1
        else
            dr ← mj - 1
        EndIf
    EndWhile
    return False
EndAlgorithm
```

Which of the following statements are true?

A. For any input value x strictly less than 10 the algorithm returns *False*.
B. The algorithm decomposes the number x into its prime factors.
C. The algorithm returns *True* if the number x is a perfect square.
D. The algorithm does not return *True* for any valid value of input parameter x.

2. Let us consider the algorithm `calculeaza(a,b)`, where a and b are natural numbers ($1 \leq a, b \leq 10000$).

```
Algorithm calculeaza(a, b):
    x ← 1
    For i ← 1, b execute
        x ← (x MOD 10) * a
    EndFor
    return x
EndAlgorithm
```

Which of the following statements are true?

A. If a = 107 and b = 101, the algorithm returns the value 107.
B. If a = 1001 and b = 101, the algorithm returns the value 1001.
C. For all algorithm calls with $1 \leq a \leq 10000$ and b = 101, the returned value is equal to a.
D. For all algorithm calls with a = 1001 and $1 \leq b \leq 10000$, the returned value is equal to 1001.

3. Let us consider the algorithm `afis(n)`, where ***n*** is a natural number ($0 \leq n \leq 10000$).

```
Algorithm afis(n):
    Write n, " "
    If n > 0 then
        afis(n DIV 2)
        Write n, ", "
    EndIf
EndAlgorithm
```

Which of the following statements are true for the call `afis(n)`?

A. The algorithm prints an array of numbers in which the first element is equal to the last element, the second element is equal to the second to last element, etc (except for the middle element).
B. The algorithm prints an array of even numbers.
C. The algorithm prints an array of numbers in ascending order followed by numbers in descending order.
D. The algorithm prints an array of numbers in descending order followed by numbers in ascending order.

4. Let us consider the algorithm `cauta(n, b)`, where ***n*** and ***b*** are natural numbers ($0 \leq n \leq 10^6$, $2 \leq b < 10$).

```
Algorithm cauta(n, b):
    v ← 0
    If n = 0 then
        return 1
    else
        m ← n
        While m > 0 execute
            If m MOD b = 0 then
                v ← v + 1
            EndIf
            m ← m DIV b
        EndWhile
        return v
    EndIf
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm computes and returns the number of digits of ***n***.
B. The algorithm returns 1 if the number ***n*** is a power of ***b*** and 0 otherwise.
C. The algorithm computes and returns the number of digits equal to 0 from the representation in base ***b*** of number ***n***.
D. The algorithm returns 1 if number ***n*** ends in digit ***b*** and 0 otherwise.

5. Let us consider the algorithm `abc(a, n, p)`, where ***n*** is a natural number ($1 \leq n \leq 10000$), ***p*** is an integer number ($-10000 \leq p \leq 10000$), and ***a*** is an array of ***n*** non-zero natural numbers (***a***[1], ***a***[2], …, ***a***[n]).

```
Algorithm abc(a, n, p):
    If n < 1 then
        return -1
    else
        If (1 ≤ p) AND (p ≤ n) then
            return a[p]
        else
            return 0
        EndIf
    EndIf
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm returns 0 if and only if ***p*** is a negative number or is greater than ***n***.
B. The algorithm returns the element on position ***p*** if ***p*** is strictly greater than 0 and less than or equal to the length of the array.
C. The algorithm never returns 0 for parameter values that meet the given preconditions.
D. The algorithm returns the element at position ***p*** if ***p*** is greater than or equal to 0 and strictly less than the length of the array.

6. In order to generate al the numbers with ***n*** digits composed only of digits 0, 6, 7, there is an algorithm which, for ***n*** = 2, generates in ascending order the numbers 60, 66, 67, 70, 76, 77.
If ***n*** = 4 and the same algorithm is used, what is the number generated immediately after the number 6767?

A. 7667
B. 6760
C. 6776
D. None of the other variants are correct.

7. For a natural number ***nr*** (1000 ≤ ***nr*** ≤ 1000000), we define the decrement operation as follows: if the last digit of ***nr*** is not 0, we subtract 1 from ***nr***, otherwise, we divide ***nr*** by 10 and we keep the integer part of the quotient. Which of the following algorithms, for the call `decrementare(nr, k)`, return the number obtained by applying the decrement operation ***k*** times (0 ≤ ***k*** ≤ 100) on the number ***nr***? For example, for ***nr*** = 15243 and ***k*** = 10, the result will be 151.

A.
```
Algorithm decrementare(nr, k):
    If k = 0 then
        return nr
    else
        If nr MOD 10 ≠ 0 then
            return decrementare(nr - 1, k - 1)
        Else
            return decrementare(nr DIV 10, k - 1)
        EndIf
    EndIf
EndAlgorithm
```

B.
```
Algorithm decrementare(nr, k):
    While k > 0 execute
        If nr MOD 10 = 0 then
            nr ← nr DIV 10
        else
            nr ← nr - 1
        EndIf
        k ← k - 1
    EndWhile
    return nr
EndAlgorithm
```

C.
```
Algorithm decrementare(nr, k):
    For i ← 1, k execute
        If nr MOD 10 > 0 then
            nr ← nr DIV 10
        else
            nr ← nr - 1
        EndIf
    EndFor
    return nr
EndAlgorithm
```

D.
```
Algorithm decrementare(nr, k):
    If k = 0 then
        return nr
    else
        If k > nr MOD 10 then
            nr1 ← nr DIV 10
            return decrementare(nr1,  k - nr MOD 10 - 1)
        else
            return decrementare(nr - k, 0)
        EndIf
    EndIf
EndAlgorithm
```

8. Let us consider the algorithm `fn` with the following parameter specification: an array ***v*** with ***n*** natural numbers (***v***[1], ***v***[2], …, ***v***[***n***]) and the integer number ***n*** ($1 \leq n \leq 10000$).

```
Algorithm fn(v, n):
    a ← 0
    For i ← 1, n execute
        ok ← True
        b ← v[i]
        While (b ≠ 0) AND (ok = True) execute
            If b MOD 2 = 1 then
                ok ← False
            EndIf
            b ← b DIV 10
        EndWhile
        If ok = True then
            a ← a + 1
        EndIf
    EndFor
    return a
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm returns the number of odd elements from vector ***v***.
B. The algorithm returns the number of elements from vector ***v*** that are powers of 2.
C. The algorithm returns the number of elements from vector ***v*** that contain only even digits.
D. The algorithm returns the number of elements from vector ***v*** that contain only odd digits.

9. The algorithm `magic(s, n)` has as input parameters an array ***s*** of ***n*** characters (***s***[1], ***s***[2], …, ***s***[***n***]) and the integer number ***n*** ($1 \leq n \leq 10000$).

```
Algorithm magic(s, n):
    i ← n
    While 1 ≤ i execute
        If s[i] ≠ s[n - i + 1] then
            return 0
        EndIf
        i ← i - 1
    EndWhile
    return 1
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm returns 1 if **s** has an even number of characters.
B. The algorithm returns 1 if **s** is a palindrome.
C. The algorithm contains an error since the expression $n - i + 1$ can have negative values during execution.
D. The algorithm returns 1 if ***s*** contains only alphanumeric characters.

10. Let us consider the following sequence of pseudocode statements:

```
Read a
   For i ← 1, a - 1 execute
       For j ← i + 2, a execute
           If i + j > a - 1 then
               Write a, " ", i, " ", j
               Write new line
           EndIf
       EndFor
   EndFor
```

How many pairs of solutions will be printed after executing the pseudocode sequence for $a = 9$?

A. 13
B. 15
C. 19
D. None of the other variants are correct.

11. The algorithm `ceFace(n)` has as input parameter a natural number n ($0 \leq n \leq 10000$).

```
Algorithm ceFace(n):
    s ← 0
    While n > 0 execute
       c ← n MOD 10
       If c MOD 2 = 0 then
           s ← s + c
       EndIf
       n ← n DIV 10
    EndWhile
    return s
EndAlgorithm
```

What is the value returned by the call `ceFace(9876)`?

A. 16　　B. 48　　C. 14　　D. 63

12. The algorithm `generare(n)` processes a natural number n ($0 < n < 100$).

```
Algorithm generare(n):
    nr ← 0
    For i ← 1, 1801 execute
        used[i] ← False
    EndFor
    While not used[n] execute
        sum ← 0
        used[n] ← True
        While n ≠ 0 execute
            digit ← n MOD 10
            n ← n DIV 10
            sum ← sum + digit * digit * digit
        EndWhile
        n ← sum
        nr ← nr + 1
    EndWhile
    return nr
EndAlgorithm
```

Which of the following statements are true?

A. If $\boldsymbol{n}$ = 10, the algorithm returns 2.
B. If $\boldsymbol{n}$ = 10, the algorithm returns 1.
C. If $\boldsymbol{n}$ = 3, the algorithm returns 4.
D. The two calls `generare(3)` and `generare(30)` will return the same value.

13. The algorithm `f(a, b)` has as input parameters two natural numbers $\boldsymbol{a}$ and $\boldsymbol{b}$ ($1 \le \boldsymbol{a} < \boldsymbol{b} \le 1000$):

```
Algorithm f(a, b):
   If a > 0 then
      return b + f(a DIV 2, b * 2)
   EndIf
   return b + f(a * 2, b DIV 2)
EndAlgorithm
```

Unfortunately, the algorithm calls itself recursively an infinite number of times. State what will be the value of $\boldsymbol{b}$ when variable $\boldsymbol{a}$ becomes 0 for the first time. The algorithm is called using the instruction:
`c ← f(20, 10)`

A. 100
B. 160
C. 320
D. 640

14. Which of the following expressions have the value *true* if and only if the natural number $\boldsymbol{n}$ is divisible by 3 and has the last digit 4 or 6:

A. `(n MOD 3 = 0) OR ((n MOD 10 = 4) AND (n MOD 10 = 6))`
B. `(n MOD 6 = 0) AND ((n MOD 10 = 4) OR (n MOD 10 = 6))`
C. `((n MOD 9 = 0) AND (n MOD 10 = 4)) OR ((n MOD 3 = 0) AND (n MOD 10 = 6))`
D. `(n MOD 3 = 0) AND (((n MOD 2 = 0) AND (n MOD 5 = 0)) OR ((n MOD 2 = 0) AND (n MOD 5 = 1)))`

15. Let us consider the following logical expression `(X OR Z) AND (X OR Y)`. Choose the values for ***X***, ***Y***, ***Z*** such that the evaluation of the expression gives the result *True*:

A. `X ← False; Y ← False; Z ← True;`
B. `X ← True; Y ← False; Z ← False;`
C. `X ← False; Y ← True; Z ← False;`
D. `X ← True; Y ← True; Z ← True;`

16. Consider all strings of length $\boldsymbol{l} \in \{1, 2, 3\}$ consisting of letters in the set $\{a, b, c, d, e\}$. How many of these strings have elements ordered in strictly ascending order and also having an odd number of consonants? (*b*, *c* and *d* are consonants)

A. 14
B. 13
C. 26
D. 81

17. In order to display a square together with its diagonals, we will use the characters * (asterisk) and . (dot) (for the space inside the square except the diagonals). The following example displays a square having a side of $\boldsymbol{n}$ = 6 asterisks. For this representation, 28 asterisks and 8 dots were required.

```
* * * * * *
* * . . * *
* . * * . *
* . * * . *
* * . . * *
* * * * * *
```

Which of the following statements are true?

A. For n = 5, precisely 22 asterisks and 4 dots are required.
B. For n = 7, precisely 34 asterisks and 15 dots are required.
C. For n = 7, precisely 33 asterisks and 16 dots are required.
D. For n = 18, precisely 100 asterisks and 224 dots are required.

18. Let us consider the algorithm `ceFace(T, n, e)`, having as a parameter an array ***T*** of ***n*** natural numbers in ascending order (***T***[1], ***T***[2], …, ***T***[***n***]) and natural numbers ***n*** and ***e*** ($1 \leq n, e \leq 10000$).

```
Algorithm ceFace(T, n, e):
    If e MOD 2 = 0 then
        a ← 1
        b ← n
        While a ≤ b execute
            m ← (a + b) DIV 2
            If e < T[m] then
                b ← m - 1
            else
                If e > T[m] then
                    a ← m + 1
                else
                    return m
                EndIf
            EndIf
        EndWhile
        return 0
    else
        c ← 1
        g ← 0
        While (c ≤ n) AND (g = 0) execute
            If e = T[c] then
                g = c
            EndIf
            c ← c + 1
        EndWhile
        return g
    EndIf
EndAlgorithm
```

Which of the following statements are true?

A. The algorithm returns 0 if number ***e*** does not belong to the array ***T***.
B. If the number ***e*** is odd and belongs to the array ***T***, the algorithm returns the index of ***e*** in ***T*** using the binary search algorithm.
C. If the number ***e*** is odd and belongs to the array ***T***, the algorithm returns the index of ***e*** in ***T*** using the sequential search algorithm.
D. The algorithm returns the index of ***e*** in ***T***.

19. Let us consider the algorithm `calcul(x, n)`, where the input parameters are the natural numbers $\boldsymbol{n}$ and $\boldsymbol{x}$ ($1 \le \boldsymbol{x} \le \boldsymbol{n} < 10$).

```
Algorithm calcul(x, n):
    b ← 1
    For i ← 1, n - x execute
        b ← b + i
    EndFor
    a ← b
    For i ← n – x + 1, n execute
        a ← a + i
    EndFor
    return a - b
EndAlgorithm
```

Which of the following statements are true?

A. If $\boldsymbol{n} = 5$ and $\boldsymbol{x} = 2$, the algorithm returns 20.
B. If $\boldsymbol{n} = 3$ and $\boldsymbol{x} = 2$, the algorithm returns 5.
C. The algorithm returns the cardinality of the set $\{\overline{c_1 c_2 \ldots c_x} : c_i \neq c_j \ \forall\ 1 \le \boldsymbol{i}, \boldsymbol{j} \le \boldsymbol{x}, \boldsymbol{i} \neq \boldsymbol{j}, 1 \le c_i \le \boldsymbol{n}\}$
D. The algorithm always returns a value strictly greater then 0.

20. Let us consider the algorithm `s(a, b, c)`, where $\boldsymbol{a}$, $\boldsymbol{b}$, $\boldsymbol{c}$ are positive natural numbers ($1 \le \boldsymbol{a}, \boldsymbol{b}, \boldsymbol{c} \le 10000$).

```
Algorithm s(a, b, c):
    If (a = 1) OR (b = 1) OR (c = 1) then
        return 1
    else
        If a > b then
            return a * s(a - 1, b, c)
         else
            If a < b then
                return b * s(a, b - 1, c)
            else
                return c * s(a - 1, b - 1, c - 1)
            EndIf
        EndIf
    EndIf
EndAlgorithm
```

20a. Which of the following statements are true when $\boldsymbol{a} = \boldsymbol{b}$ and $\boldsymbol{a} < \boldsymbol{c}$?

A. The algorithm computes and returns $\boldsymbol{c}! / (\boldsymbol{c} - \boldsymbol{a})!$
B. The algorithm computes and returns $\boldsymbol{c}! / (\boldsymbol{c} - \boldsymbol{a} + 1)!$
C. The algorithm computes and returns $\boldsymbol{c}! / (\boldsymbol{c} - \boldsymbol{a} - 1)!$
D. The algorithm computes and returns the number of combinations of $\boldsymbol{c}$ taken ($\boldsymbol{a}$ - 1) at a time

20b. Given $\boldsymbol{a} = 3$, $\boldsymbol{b} = 4$, $\boldsymbol{c} = 7$, the algorithm returns:

A. 224
B. 56
C. 336
D. 168

21. Let us consider the algorithm `numere(a, b, c, d, e)`, which receives as input parameters five integer numbers $\boldsymbol{a}$, $\boldsymbol{b}$, $\boldsymbol{c}$, $\boldsymbol{d}$ and $\boldsymbol{e}$ ($1 \le \boldsymbol{a}, \boldsymbol{b} \le 10000$, $2 \le \boldsymbol{c} \le 16$, $1 \le \boldsymbol{d} < \boldsymbol{c}$).

```
Algorithm numere(a, b, c, d, e):
    If a = 0 AND b = 0 then
        If e = 0 then
            return True
        else
            return False
        EndIf
    EndIf
    If a MOD c = d then
        e = e + 1
    EndIf
    If b MOD c = d then
        e = e - 1
    EndIf
    return numere(a DIV c, b DIV c, c, d, e)
EndAlgorithm
```

Which of the following statements are true when calling `numere(a, b, c, d, 0)`**?**

A. The algorithm returns *True* if the representations in base ***c*** of the numbers ***a*** and ***b*** contain the digit ***d*** occurring an equal number of times and *False* otherwise
B. The algorithm returns *True* if digit ***d*** occurs in the base ***c*** representation of the number ***a*** and in the base ***c*** representation of the number ***b***, *False* otherwise
C. Calling `numere(a, b, c, d, 0)` returns the same value as when calling `numere(b, a, c, d, 0)`
D. The algorithm returns *True* if the digit ***d*** occurs on the same positions in the base ***c*** representation of the numbers ***a*** and ***b*** and *False* otherwise

22. Let us consider the array ***s*** of natural numbers where:

$$s_i = \begin{cases} x, & \text{if } i = 1 \\ x + 1, & \text{if } i = 2 \\ s_{(i-1)} @ s_{(i-2)} & \text{if } i > 2 \end{cases}$$

, (***i*** = 1, 2, ...). The operator @ concatenates the digits from the left and right operands, in this order (the digits of base 10 representation), and ***x*** is a natural number (1 ≤ ***x*** ≤ 99). For example, if ***x*** = 3, the array ***s*** is 3, 4, 43, 434, 43443, ... For a natural number ***k*** (1 ≤ ***k*** ≤ 30) state the number of digits of the item in ***s*** that precedes the item having ***k1*** digits, where ***k1*** is the lowest number where ***k*** ≤ ***k1*** ≤ 30 and there exists an item having ***k1*** digits.

A. for ***x*** = 15 and ***k*** = 8, the number of digits of the desired item is 6.
B. for ***x*** = 2 și ***k*** = 6, the number of digits of the desired item is 6.
C. for ***x*** = 14 și ***k*** = 27, the number of digits of the desired item is 26.
D. for ***x*** = 5 și ***k*** = 12, the number of digits of the desired item is 8.

23. Let us consider the following recursive algorithm `fibonacci(n)`, where ***n*** is a natural number (1 ≤ ***n*** ≤ 100). Determine the number of times that the message "`Aici`" is displayed for a call of `fibonacci(n)`.

```
Algorithm fibonacci(n):
    If n ≤ 1 then
        Write "Aici"
        return 1
    else
        return fibonacci(n - 1) + fibonacci(n - 2)
    EndIf
EndAlgorithm
```

A. `fibonacci(n)` number of times.
B. `fibonacci(n-1)` number of times.
C. `fibonacci(n)-1` number of times.
D. `fibonacci(n) - fibonacci(n-1)` number of times.

24. Consider the expression: $\boldsymbol{E(x) = a_0 + a_1 * x + a_2 * x^2 + a_3 * x^3 + a_4 * x^4}$, where $\boldsymbol{a_0}$, $\boldsymbol{a_1}$, $\boldsymbol{a_2}$, $\boldsymbol{a_3}$, $\boldsymbol{a_4}$ and $\boldsymbol{x}$ are non-zero real numbers. The minimum number of multiplications needed to compute the value of the expression ***E(x)*** is:

A. 4
B. 5
C. 7
D. 3

25. Let us consider the algorithm `f(x, n)` where ***x***, ***n*** are natural numbers and ***x*** > 0.

```
1.  Algorithm f(x, n):
2.      If n = 0 then
3.          return 1
4.      EndIf
5.      m ← n DIV 2
6.      p ← f(x, m)
7.      If n MOD 2 = 0 then
8.          return p * p
9.      EndIf
10.     return x * p * p
11. EndAlgorithm
```

25a. Which of the following statements are true?

A. The algorithm returns $\boldsymbol{x^n}$ running approximately ***n*** recursive calls.
B. The algorithm returns $\boldsymbol{x^n}$ making approximately $\boldsymbol{log_2\, n}$ recursive calls.
C. The algorithm returns $\boldsymbol{x^n}$ if and only if ***n*** is a power of 2
D. The algorithm returns $\boldsymbol{x^n}$ if and only if ***n*** is even.

25b. Let us consider line 10 replaced with:

```
10.     return x * f(x, n – 1)
```

Which of the following statements are true?
A. The algorithm does not return $\boldsymbol{x^n}$ anymore
B. The algorithm returns $\boldsymbol{x^{n+1}}$
C. The algorithm runs approximately $\boldsymbol{n^2}$ recursive calls.
D. The algorithm returns $\boldsymbol{x^n}$

26. Let us consider the algorithm `f2(a,b)` having parameters ***a*** and ***b*** natural numbers, and the algorithm `f(arr, i, n, p)` having as parameters the array ***arr*** with ***n*** integers (***arr***[1], ***arr***[2], …, ***arr***[n]), and the integers ***i*** and ***p***.

```
Algorithm f2(a, b):
    If a > b then
        return a
    else
        return b
    EndIf
EndAlgorithm

Algorithm f(arr, i, n, p):
    If i = n then
        return 0
    EndIf
    n1 ← f(arr, i + 1, n, p)
    n2 ← 0
    If p + 1 ≠ i then
        n2 ← f(arr, i + 1, n, i) + arr[i]
    EndIf
    return f2(n1, n2)
EndAlgorithm
```

State which is the result of calling `f(arr, 1, 9, -10)`, if the array ***arr*** has the values (10, 1, 5, 4, 7, 12, 1, 12, 6).

A. 24
B. 37
C. 39
D. 56

27. Let us consider the algorithm `f(n)`, having as a parameter the nonzero natural number ***n*** which returns a natural number.

```
Algorithm f(n):
   j ← n
   While j > 1 execute
      i ← 1
      While i ≤ n⁴ execute
         i ← 4 * i
         Write "*"
      EndWhile
      If j DIV 2 > 1 then
         Write " "
      EndIf
      j ← j DIV 2
   EndWhile
   return j
EndAlgorithm
```

27a. The time complexity of the algorithm belongs to which of the following complexity classes?

A. $O(\log_2 \boldsymbol{n})$
B. $O(\log_2^2 \boldsymbol{n})$
C. $O(\log_4^2 \boldsymbol{n})$
D. $O(\log_2 \log_4 \boldsymbol{n})$

27b. Which of the following statements are true?

A. If ***n*** = 10, the algorithm displays groups of 7 asterisks, groups being separated by a space.
B. If ***n*** = 20, the algorithm displays 4 groups of asterisks and 4 space characters.
C. If ***n*** = 25, the algorithm displays 48 asterisks, and after each group displays one space.
D. If ***n*** = 100, the algorithm displays 84 asterisks and 5 space characters.

BABEŞ-BOLYAI UNIVERSITY

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Mate-Info UBB Contest March 25th 2022
Written Exam for Computer Science

GRADING AND SOLUTIONS
23 – 03 - 2022

DEFAULT: 10 points

1	C	3 points
2	ABD	3 points
3	AD	3 points
4	C	3 points
5	B	3 points
6	D	3 points
7	ABD	3 points
8	C	3 points
9	B	3 points
10	C	3 points
11	C	3 points
12	ACD	3 points
13	C	3 points
14	B	3 points
15	BD	3 points
16	B	3 points
17	CD	3 points
18	AC	3 points
19	BD	3 points
21	AC	3 points
22	AD	3 points
23	A	3 points
24	A	3 points
26	C	3 points
20a	B	3 points
20b	D	3 points
25a	B	3 points
25b	D	3 points
27a	BC	3 points
27b	AD	3 points

UNIVERSITATEA BABEŞ-BOLYAI
FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ

Concurs Mate-Info – martie 2021

Proba scrisă la Informatică

NOTĂ IMPORTANTĂ:
În lipsa altor precizări, presupuneți că toate operatiile aritmetice se efectuează pe tipuri de date nelimitate (nu există *overflow* / *underflow*).
De asemenea, numerotarea indicilor tuturor șirurilor începe de la 1.

1. Se consideră expresia următoare, în care *a* este un număr natural.

```
((a < 4) SAU (a < 5)) ȘI (a > 2)
```

Pentru ce valori ale lui *a* va avea expresia valoarea ***ADEVĂRAT***?

A. a = 3
B. a = 4
C. a = 2
D. Expresia nu va avea niciodată valoarea ***ADEVĂRAT***

2. Subalgoritmul de mai jos are ca parametri de intrare un șir **v** cu **n** numere naturale nenule (v[1], v[2], …, v[n]) și numărul întreg **n** ($1 \leq n \leq 10000$).

```
Subalgoritm f(v, n):
    x ← 0
    Pentru i ← 1, n execută
        c ← v[i]
        Câttimp c MOD 3 = 0 execută
            x ← x + 1
            c ← c DIV 3
        SfCâttimp
    SfPentru
    returnează x
SfSubalgoritm
```

Precizați care dintre următoarele afirmații sunt adevărate:

A. Subalgoritmul returnează numărul numerelor divizibile cu 3 din șirul ***v***
B. Subalgoritmul returnează cel mai mare număr ***k*** astfel încât v[1] * v[2] * … * v[n] este divizibil cu 3^k
C. Subalgoritmul returnează cel mai mare număr ***k*** astfel încât v[1] + v[2] + … + v[n] este divizibil cu 3^k
D. Subalgoritmul returnează suma numerelor divizibile cu 3 din șirul ***v***