

CHESTIONAR DE CONCURS

– MATEMATICĂ –

1. Fie polinomul $P(X) = X^3 + mX^2 + X + m \in \mathbb{R}[X]$ cu rădăcinile $x_1, x_2, x_3 \in \mathbb{C}$. Valoarea parametrului real m pentru care $x_1^3 + x_2^3 + x_3^3 = 8$ este:

a) $m = -2$; b) $m = 0$; c) $m = -1$; d) $m = 2$.

2. Fie funcția $f: \mathbb{R} \rightarrow \mathbb{R}$ definită prin $f(x) = (x+3)^{2/3} + (x-3)^{2/3}$. Pentru această funcție punctele de abscisă $x_1 = 3$ și $x_2 = -3$ sunt:

a) puncte de discontinuitate; b) puncte de întoarcere; c) puncte unghiulare;
d) puncte critice (în care derivata se anulează).

3. Fie matricile $\mathbf{A} = \begin{bmatrix} -2 & -1 \\ 0 & 1 \\ 1 & 2 \end{bmatrix}$ și $\mathbf{B} = \begin{bmatrix} 2 & -1 & -1 & 0 \\ 1 & 1 & -1 & 1 \end{bmatrix}$ și $\mathbf{X} = \mathbf{A} \cdot \mathbf{B}$.

Atunci rangul matricii \mathbf{X} este:

a) rang $\mathbf{X} = 4$; b) rang $\mathbf{X} = 1$; c) rang $\mathbf{X} = 3$; d) rang $\mathbf{X} = 2$.

4. Valoarea limitei $l = \lim_{n \rightarrow \infty} \left(\sqrt{n^2 + n + 1} - \sqrt{n^2 - n + 1} \right)$ este:

a) $l = 0$; b) $l = 2$; c) $l = 1$; d) $l = \infty$.

5. Produsul P al soluțiilor pozitive ale ecuației $\begin{vmatrix} x & -1 & 1 \\ -1 & x & -1 \\ 1 & -1 & x \end{vmatrix} = 0$ este:

a) $P = 3$; b) $P = 2$; c) $P = 4$; d) $P = 1$.

6. Se consideră funcția $f : [0, 2] \rightarrow \mathbb{R}$, $f(x) = \begin{cases} x^3 + ax^2 + bx + c, & \text{dacă } x \leq 1 \\ \operatorname{arctg}(x-1), & \text{dacă } x > 1 \end{cases}$

Dacă parametrii reali a, b, c sunt astfel încât funcția f să satisfacă condițiile teoremei Rolle și dacă $E = a^2 - b - c^2$, atunci:

a) $E = 1$; b) $E = 1 + \frac{\pi}{4}$; c) $E = -\frac{\pi}{2}$; d) $E = \frac{\pi^2}{16} - 1$.

7. Volumul V al corpului obținut prin rotația graficului funcției $f : [0, 2] \rightarrow \mathbb{R}$, $f(x) = 2x - x^2$ în jurul axei Ox este:

a) $V = 2\pi$; b) $V = \frac{16\pi}{15}$; c) $V = \frac{\pi}{3}$; d) $V = \pi + 1$.

8. Suma rădăcinilor ecuației $\sqrt[3]{x^3 + x^2 - x - 2} = x$ este:

a) $S = 0$; b) $S = 2$; c) $S = 1$; d) $S = -1$.

9. Fie funcția $f : [0, 2] \rightarrow \mathbb{R}$, $f(x) = \begin{cases} 1, & x \in [0, 1] \\ x^2, & x \in (1, 2] \end{cases}$.

Valoarea integralei $\int_0^2 e^x \cdot f(x) dx$ este:

a) $e^2 - 1$; b) $2e^2 - 1$; c) $\frac{1}{2}e^2 + 1$; d) $e^2 + 2$.

– INFORMATICĂ –

1. Precizați ce afișează programul următor.

```
int f(int x)
{
    if (x == 0)
        return 10;
    else
        if (x % 5 == 0)
            return f(x / 10) * 10 + x;
        else
            return f(x / 10) * (x % 10);
}
void main()
{
    printf("%d", f(2504));
}
```

- a. 2500
- b. 4400
- c. 10000
- d. 2000

2. Fie v , un vector de n elemente întregi, sortate crescător. Se dorește inserarea în vector a unui nou element, x , păstrând proprietatea ca vectorul să fie sortat crescător. Menționați cu ce trebuie înlocuită linia punctată pentru a îndeplini cerința.

```
int i;
for (i = n; i > 0; i--)
{
    .....
    v[i] = v[i - 1];
    else
    {
        v[i] = x;
        break;
    }
}
if (v[0] > x)
    v[0] = x;
n++;
```

- a. `if (v[i - 1] > x)`
- b. `for(j=0;j<x;j++)`
- c. `if (v[i] < x)`
- d. `while(i>0)`

3. Indicați valoarea afișată pe ecran după execuția programului următor.

```
void main()
{
    int i = 0, c = 23, d = 51;
    d = i || c;
    i = d && c;
    c = !(d && i);
    printf("%d", c);
}
```

- a. 1
- b. 0
- c. 89
- d. 23

4. Precizați ce se va afișa în urma execuției programului următor:

```
void f(int A[], int n)
{
    int i, x;
    for (i = 0; i < n / 2; i++)
    {
        x = A[i];
        A[i] = A[n - 1 - i];
        A[n - 1 - i] = x;
    }
    for (i = 0; i < n; i++)
        printf("%d ", A[i]);
}

void main()
{
    int A[] = { 1,2,3,4,5,6,7,8,9,10,11,12,13,14 };
    f(A, 8);
}
```

- a. 8 7 6 5 4 3 2 1
- b. 7 6 5 4 3 2 1 8
- c. 9 10 11 12 13 14 15 16
- d. 14 15 13 12 11 10 9 8

5. Indicați valoarea afișată pe ecran după execuția programului următor.

```
void main(){
    int i = 0, c = 0;
    char s[20] = "ACESTA ESTE UN SIR";
    for (i = 0; i < 6; i++)
        c = c + 1;
    printf("%c", s[c + 1] + 1);
}
```

- a. E
- b. A
- c. S
- d. F

6. Fie n un număr întreg din intervalul $[1, 10000]$. Precizați ce returnează funcția *func*.

```
int func(int n)
{
    int digit, c = 0;
    while (n > 0)
    {
        digit = n % 10;
        c += digit % 2;
        n = n / 10;
    }
    return c;
}
```

- Litera "c"
- Numărul de cifre impare al parametrului n
- Numărul de cifre al parametrului n
- Numărul de cifre pare al parametrului n

7. Câte componente conexe conține graful descris prin matricea de adiacență de mai jos?

$$\begin{pmatrix} 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

- 1
- 3
- 2
- 4

8. Un erou poartă o *armură* și o *casă*. Materialele din care acestea pot fi confecționate pot fi: *bronz*, *argint*, *aur*, *platină*. Purtarea concomitentă a unui obiect de *bronz* cu un obiect de *platină* este interzisă. Utilizând metoda backtracking, este generată lista completă de combinații pentru materialele din care pot fi fabricate cele două obiecte. Primele 5 combinații generate sunt:

casă – bronz, armură - bronz
casă – bronz, armură - argint
casă – bronz, armură - aur
casă – argint, armură - bronz
casă – argint, armură - argint

Indicați care este cea de-a opta combinație generată.

- casă – argint, armură - aur
- casă – aur, armură - argint
- casă – argint, armură - platină
- casă – aur, armură - bronz

9. Indicați valoarea afișată pe ecran după execuția programului următor.

```
void main(){
    int ans = 0, i = 0, b = 1, j = 0;
    int N = 10050;
    while (N != 0)
    {
        b = 1;
        if (N % 10 == 0)
        {
            for (j = 0; j < i; j++)
                b = b * 10;
            ans = ans + 1 * b;
        }
        else
        {
            for (j = 0; j < i; j++)
                b = b * 10;
            ans = ans + (N % 10) * b;
        }
        N = N / 10;
        i++;
    }
    printf("%d\n", ans);
}
```

- a. 11151
- b. 10050
- c. 01151
- d. 11613

I. Reading comprehension

Read the text below, and, for items 1-5, choose the correct answer from among the four given variants. Mark your answer on the answer sheet.

The mysterious drawings known as the Nasca lines have puzzled people since they first became widely known in the late 1920s. Before air travel in Peru began, it was impossible to get a clear view of the giant drawings of the spider, monkey and hummingbird. Yet, the Nasca people who made these patterns 2,000 years ago, couldn't have seen them from above.

One of the first formal studies of the lines was by Maria Reiche. She spent half a century working for their conservation and was convinced that the lines were part of an astronomical calendar. Other people thought they might be ancient Inca roads or irrigation systems. The strangest idea was that maybe they were landing strips for alien spacecraft!

This region of Peru is one of the driest places on Earth and yet, successful societies, including the Nasca, lived here. Water had an incredible significance to these societies, so perhaps the lines were related to this. We know that the Nasca River, which comes down from the nearby mountains, runs underground for about 15 kilometers before suddenly emerging on the surface again. This seemed an astonishing, even sacred, phenomenon to ancient societies. It has also become clear that there are more huge drawings in the area, not just the ones on the flat desert plain. Many are much older than the Nasca figures themselves, so clearly the same group of people didn't create them. Now it seems that the Nasca lines were part of a long tradition of ceremonial activities connected to water and religious beliefs.

1. When were the Nasca lines made by the people in Peru?
 - a. Two thousand years ago.
 - b. After air travel began.
 - c. Four hundred years ago.
 - d. In the late 1920s.

2. What was Maria Reiche's hypothesis regarding the meaning of the lines?
 - a. She thought they were ancient Inca roads.
 - b. She considered them part of an astronomical calendar.
 - c. She was convinced they were irrigation systems.
 - d. She believed that they were landing strips for air balloons!

3. How is this region of Peru in terms of climate?
 - a. An underground river.
 - b. A very humid area.
 - c. A mountainous region.
 - d. A very dry area.

4. What was the attitude of the ancient societies towards water?
- They considered it a religious belief in aliens.
 - They considered it a flat desert aspect.
 - They considered it an astonishing, sacred phenomenon.
 - They considered it a huge drawing of a bird.
5. What is yet another hypothesis about the Nasca lines?
- The lines are a map of the nearby hills.
 - The lines are part of a long tradition of ceremonial activities.
 - The lines are connected to the modern people.
 - The lines represent a natural phenomenon of the desert.

II. Grammar and vocabulary

Items 6 to 9 are incomplete sentences. Choose among the four variants given under each sentence the one word or phrase that completes the sentence correctly.

6. I like _____ oranges very much.
- - the
 - much
 - an
7. He always takes part _____ interesting events.
- of
 - to
 - in
 - on
8. There is _____ salt left.
- fews
 - little
 - least
 - small
9. He _____ to music when I saw him.
- listens
 - is listening
 - will listen
 - was listening

Each of the sentences from 10 to 12 contains one error. Identify the error from the four underlined words or phrases.

10. There is nothing more annoying than being interrupting when you are speaking.
a b c d

11. As soon as I choose the topic I willed let you know.
a b c d

12. When you will finish eating, let's go out for a walk.
a b c d

From 13 to 15 you have four variants derived from the word written in capitals at the end of each line. Choose the variant that best fits in the gap. Only one variant is correct.

13. We studied _____ than them for the exam. HARD
a. HARDLY
b. HARDEN
c. HARDY
d. HARDER

14. Your friendship is very _____ to me. VALUE
a. VALUABLE
b. VALLOROUSLY
c. VALUABLY
d. VALUING

15. His remarks were made _____, so don't feel offended. INTENTION
a. INTENTIONALS
b. INTENTIONEDLY
c. UNINTENTIONALLY
d. UNINTENTIONLY

From 16 to 18, each sentence has a word underlined. Choose among the four variants the one word or phrase which is the best substitute for the word underlined.

16. Jack will be punished for everything.
a. censored
b. condemned
c. denied
d. praised

17. On hearing the unexpected news, they left hurriedly.

- a. quickly
- b. slowly
- c. sadly
- d. quietly

18. During the stone age, men lived in caves.

- a. ate
- b. worked
- c. hunted
- d. stayed

Toți itemii sunt **obligatorii**.
Timpul de lucru efectiv este 180 minute.

Secretarul comisiei de admitere