


Information units	Information units	Conversion table	
1 bit – elementary unit	1 Kbit (Kilobit) = 2^{10} bits = 1024 bits	octal	binary
1B (Byte) = 8 bits	1 Mbit (Megabit) = 2^{10} Kbits (1024 Kbits)	0	000
1KB (KiloByte) = 2^{10} B (1024 B)	1 Gbit (Gigabit) = 2^{10} Mbits (1024 Mbits)	1	001
1MB (MegaByte) = 2^{10} KB (1024 KB)	1 Tbit(Terabit) = 2^{10} Gbits(1024 Gbits)	2	010
1GB (GigaByte) = 2^{10} MB (1024 MB)		3	011
1TB (TeraByte) = 2^{10} GB (1024 GB)		4	100
		5	101
		6	110
		7	111
Table of powers of number 2		Conversion table	
$2^0 = 1$		hexadecimal	binary
$2^1 = 2$	$2^9 = 512$	0	0000
$2^2 = 4$	$2^{10} = 1024$	1	0001
$2^3 = 8$	$2^{11} = 2048$	2	0010
$2^4 = 16$	$2^{12} = 4096$	3	0011
$2^5 = 32$	$2^{13} = 8192$	4	0100
$2^6 = 64$	$2^{14} = 16384$	5	0101
$2^7 = 128$	$2^{15} = 32768$	6	0110
$2^8 = 256$	$2^{16} = 65536$	7	0111
		8	1000
		9	1001
		A	1010
		B	1011
		C	1100
		D	1101
		E	1110
		F	1111
Tick the programming language which you will use to perform the problems proposed in the topics II and III:			
<input type="checkbox"/> Pascal		<input type="checkbox"/> C/C++	

Nr	Item	Score	
Topic I. (25 points)			
1	<p>In a skiing competition participated n athletes. Their names were coded using binary words of equal minimum length. The minimum length of binary words is equal to 7. It was found that 20 of these binary words were not used.</p> <p>a) Determine and write in the space reserved for the answer the total number of athletes in the competition.</p> <p>Write the used formula: _____</p> <p>Write the calculations: _____</p> <p>b) <i>Image 1</i> is a digital color photo with the size of 128x256 pixels. It contains the amount of information of 60 Kilobytes (KB). Determine the number of luminance levels of the given image. Write the result in the space reserved for the answer.</p> <p>Write the used formula: _____</p> <p>Write the calculations: _____</p>	 <p style="text-align: center;"><i>Image 1</i></p>	L 0 1 2 3 4 5 6 7 8 9 L 0 1 2 3 4 5 6 7 8 9
2	<p>a) Write in the space reserved for the answer two largest bases of positional number systems that do not contain the digit 7.</p> <p style="text-align: right;">Answer: _____, _____</p> <p>b) Let the number $N = (A2F, 8)_{16}$ be given. Determine and write in the space reserved for the answer:</p> <p>o the relationship between the number N and the number $X = (2607, 3)_{10}$ (fill in the box <input type="checkbox"/> with one of the signs $<$, $>$ or $=$).</p> <p style="text-align: right;">Answer: N <input type="checkbox"/> X</p> <p>Write the calculations: _____</p> <p>o the number N in the binary number system.</p> <p style="text-align: right;">Answer: (_____)₂</p> <p>Write the conversions: _____</p>	L 0 1 2 3 4 5 6 7 8 L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8 L 0 1 2 3 4 5 6 7 8

2	<p>To the given integer variables there have been assigned the following values: a = 57, b = 10, d = 2.</p> <p>The left column of the following table contains operators of a programming language in which some fragments designated with _____ are missing. Fill in the missing pieces so that the given expressions display the information - value and format - as shown in the right column of the same row.</p> <p>Pascal language</p> <table border="1" data-bbox="272 398 1318 752"> <thead> <tr> <th>Operator</th> <th>Display</th> </tr> </thead> <tbody> <tr> <td>if a _____ then write(2 *(a - 3) mod 10) else write(100 - a);</td> <td>8</td> </tr> <tr> <td>for i := 12 _____ b do begin c := i * b; write(c, ' '); end;</td> <td>120 110 100</td> </tr> <tr> <td>while a _____ do begin write(a div 10); a := a + 3; end;</td> <td>5</td> </tr> <tr> <td>repeat d := d * d; writeln(d); until d _____;</td> <td>4 16 256</td> </tr> </tbody> </table> <p>C++ language</p> <table border="1" data-bbox="272 864 1318 1240"> <thead> <tr> <th>Operator</th> <th>Display</th> </tr> </thead> <tbody> <tr> <td>if (a _____) cout << 2 *(a - 3)% 10; else cout << 100 - a;</td> <td>8</td> </tr> <tr> <td>for(int i = 12; i >= b; i _____) {c = i * b; cout << c << ' ' ; }</td> <td>120 110 100</td> </tr> <tr> <td>while (a _____) { cout << a / 10; a = a + 3;}</td> <td>5</td> </tr> <tr> <td>do { d = d * d; cout << d << endl; } while (d _____);</td> <td>4 16 256</td> </tr> </tbody> </table>	Operator	Display	if a _____ then write(2 *(a - 3) mod 10) else write(100 - a);	8	for i := 12 _____ b do begin c := i * b; write(c, ' '); end;	120 110 100	while a _____ do begin write(a div 10); a := a + 3; end;	5	repeat d := d * d; writeln(d); until d _____;	4 16 256	Operator	Display	if (a _____) cout << 2 *(a - 3)% 10; else cout << 100 - a;	8	for(int i = 12; i >= b; i _____) {c = i * b; cout << c << ' ' ; }	120 110 100	while (a _____) { cout << a / 10; a = a + 3;}	5	do { d = d * d; cout << d << endl; } while (d _____);	4 16 256	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8
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3	<p>Pascal language</p> <p>a) The following program fragment is given:</p> <pre> var a, b, c: real; begin a:= -10.2; b:= 17.35; c := -17.4; if a > b then a := trunc(a)*2 else if abs(trunc(c)) = abs(trunc(b)) then c := trunc(c) + 10 else b := trunc(b) + 10; write (a:0:0, ' ', b:0:0, ' ', c:0:0); </pre> <p>Write what will be displayed as a result of executing of the given program fragment:</p> <p>_____</p> <p>b) Let a sequence of operators that reads from the keyboard an integer a be given. Fill in the space reserved in the case operator with an expression so that at the screen to display the word DA if the number a is divided by 3, but is not divided by 5; otherwise, will be displayed the word NU.</p> <pre> write ('a = '); read (a); case _____ of true: write ('DA') else write ('NU'); end; </pre>	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8																				

	<p>C++ language</p> <p>a) The following program fragment is given:</p> <pre>float a = -10.2, b = 17.35, c = -17.4; if (a > b) a = trunc(a)*2; else if (abs(trunc(c)) == abs(trunc(b))) c = trunc(c) + 10; else b = trunc(b) + 10; cout << fixed <<setprecision(0)<< a <<' '<< b <<' '<< c;</pre> <p>Write what will be displayed as a result of executing of the given program:</p> <p>_____</p>		
	<p>b) Let a sequence of operators that reads from the keyboard an integer a be given. Fill in the space reserved in the switch operator with an expression so that at the screen to display the word DA if the number a is divided by 3, but is not divided by 5; otherwise, will be displayed the word NU.</p> <pre>cout<< " a = "; cin >> a; switch(_____) { case 1: cout << "DA"; break; default: cout << "NU"; }</pre>		
4	<p>20 codes of <i>the extended ASCII table</i> are read from the keyboard - integers between 0 and 255.</p> <p>Task. Write a program that determines how many of the read codes correspond to the cod of character '+'.</p> <p>Output. A single integer is displayed on the screen – the number of <i>the extended ASCII table</i> codes read from the keyboard, which correspond to the cod of character '+'.</p>	L 0 1 2 3 4 5 6 7	L 0 1 2 3 4 5 6 7

Topic III. (30 points)

1	<p>Let Pascal program be given:</p> <pre> program pr1; Var x, q, w: integer; function ch(y: integer): boolean; Var k : integer; begin k:= sqr(trunc(sqrt(y))) ; if k = y then ch:= true else ch:=false; end; procedure num(x: integer); begin q := 0; repeat if ch(x mod 10) then w:= w*10 +(x mod 10) else q:= q + 1; x := x div 10; until x = 0; end; begin x := 24971; w := 0; num(x); writeln(w, ' ', q); readln end.</pre>	<p>Perform the following tasks for the program pr1:</p> <p>a) Write the number of local variables used in the program pr1. _____</p> <p>b) Underline in the text of the program pr1 the header of the num procedure. _____</p> <p>c) Write the value of the actual parameter used in the second call of the ch function: _____</p> <p>d) Write the value returned by the ch function after the last call: _____</p> <p>e) Check the truth value of the statement "Program pr1 contains standard functions": <input type="checkbox"/> True <input type="checkbox"/> False</p> <p>f) Write what will be displayed as a result of executing the program pr1: _____</p>	L 0 1 2 3 4 5 6 7	L 0 1 2 3 4 5 6 7
	<p>Let C++ program be given:</p> <pre> //program pr1 #include <iostream> #include <cmath> using namespace std; int x, q, w; bool ch(int y) { int k; k = pow(int (sqrt(y)), 2); if (k == y) return true; else return false; } void num (int x) { q = 0; do { if (ch(x % 10)) w = w*10 + (x % 10); else q = q + 1; x = x / 10; } while (x != 0); } int main() { x = 24971; w = 0; num (x); cout << w << ' ' << q ; }</pre>	<p>Perform the following tasks for the program pr1:</p> <p>a) Write the number of local variables used in the program pr1: _____</p> <p>b) Underline in the text of the program pr1 the header of the num function. _____</p> <p>c) Write the value of the actual parameter used in the second call of the ch function: _____</p> <p>d) Write the value returned by the ch function after the last call: _____</p> <p>e) Check the truth value of the statement "Program pr1 contains standard functions": <input type="checkbox"/> True <input type="checkbox"/> False</p> <p>f) Write what will be displayed as a result of executing the program pr1: _____</p>		

2

In a competition organized by a trade school, n students participated. Students received indexes from 1 to n . The students were proposed to model 2 pieces. Each modeled piece is rated from 1 to 20 points. For pieces that have not been modeled, students receive 0 points.

Task: Write a program that determines the number of students who modeled both pieces and the maximum score earned by students who modeled both pieces.

The program will contain a subprogram named `pc`, which will receive as a parameter an integer i – index of a student and will return 0 if the student has not modeled at least one piece; if the student modeled both pieces, then the function will return the total earned score.

Input: The text file `piese.in` contains in the first line an integer n ($1 \leq n \leq 30$) – the number of students who participated in the competition. Next n lines contain two integers from 1 to 20 separated by space – points accrued for modeled pieces or 0 for pieces that were not modeled. The line $i+1$ contains the points accumulated by student with index i for each of the two pieces.

Output: The text file `piese.out` will contain in one line two integers separated by a space - the number of students who modeled both pieces and the maximum score earned by the students who modeled both pieces.

Note. It is known that there are students who modeled both pieces.

Example:	<code>piese.in</code>	<code>piese.out</code>	The solution will be appreciated for:
	6 5 6 0 16 15 18 14 19 20 0 14 15	4 33	types and variable declarations; operations with the text files; reading and writing data; algorithm organization.

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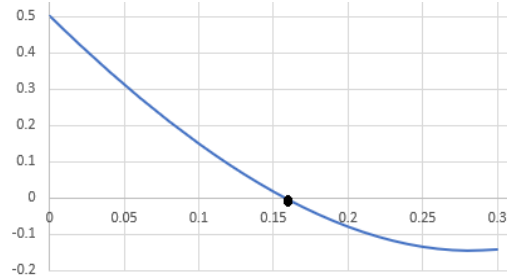
The glider trajectory is described by the function $f(x) = e^{3x} - 7x - 0,5$ on the segment $[0; 0,3]$.

Write a program that will solve the equation $f(x) = 0$ for $x \in [a; b]$ using the chord method. The program will calculate $n=20$ successive approximations.

Input: The values of the extremities of the segment $[a; b]$ and the number of divisions n of the given segment are assigned directly in the program text.

Output: There will be displayed n lines on the screen. Each line will contain two numbers separated by a space: the number of the iteration and the value of the approximation x for the given iteration.

Note. The fixed extremity is $e=a$, and the initial approximation is $x_0=b$.



The following algorithm can be used to solve the equation:

Step 0. Initialization: $a \leftarrow 0, b \leftarrow 0,3, e \leftarrow a, x_0 \leftarrow b, n \leftarrow 20.$

Step 1. For all i from 1 to n :

- x_i is calculated according to the formula

$$x_i \leftarrow x_{i-1} - \frac{f(x_{i-1})}{f(e) - f(x_{i-1})} (e - x_{i-1})$$

- the number of the iteration and the value of the approximation x for the given iteration are displayed.

Note: the sign \leftarrow has the meaning of "attribution of value".

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Topic IV. (13 points)

1 A database was created in the MS Access system to record the IT courses for students. Fragments of the tables of this database are shown in *Image 2*:

Module					Cursuri			
Cod_modul	Denumire	Numar_ore	Online	Cod_curs	Cod_elev	Cod_modul	Inceput	
M_01	C++	70	<input checked="" type="checkbox"/>	1	2	M_04	1/14/2024	
M_02	PYTHON	60	<input checked="" type="checkbox"/>	2	3	M_04	1/14/2024	
M_03	CSS	30	<input type="checkbox"/>	3	1	M_06	2/25/2024	
M_04	HTML	40	<input type="checkbox"/>	4	4	M_06	2/25/2024	
M_05	JAVASCRIPT	60	<input checked="" type="checkbox"/>	5	2	M_03	3/17/2024	
M_06	ROBOTICA	70	<input type="checkbox"/>	6	7	M_03	3/17/2024	

Elevi					
Cod_elev	Nume	Prenume	Clasa	E_mail	
1	Lungu	Ion	8	ion.lungu@gmail.com	
2	Cojocari	Ilinca	9	c.ilinca22@yahoo.com	
3	Untu	Vasile	11	untu_v@mail.md	
4	Luchian	Vlad	7	vladluchian@gmail.com	
5	Matei	Tatiana	9	ion.lungu@gmail.com	
6	Miron	Oxana	10	miron222@mail.md	

Image 2

Using the data from the database tables:

- a) Fill in *Image 3* all the necessary elements, including the relations between the tables, and define in **Design View** mode a grouping and totaling query that will display data from three fields - *Denumire*, *Inceput* and *Cod_elev*. The query will display the number of students studying different modules remotely (function *Count*, *Cod_elev* field) starting from February (second month). Records will be grouped by the *Denumire* field, the *Inceput* field, and the *Online* field.

Query1

Field:			Cod_elev	
Table:			Elevi	
Total:				Group By
Sort:				
Show:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Criteria:				
or:				

Image 3

b) Write in the space reserved:

- o The name of the **primary key** field in the Cursuri table: _____
- o The name of a **foreign key** field in the Cursuri table: _____

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