

Information units 1 bit – elementary unit 1 B (Byte) = 8 bits 1 KB (KiloByte) = 2^{10} B (1024 B) 1 MB (MegaByte) = 2^{10} KB (1024 KB) 1 GB (GigaByte) = 2^{10} MB (1024 MB) 1 TB (TeraByte) = 2^{10} GB (1024 GB)	Information units 1 Kbit (Kilobit) = 2^{10} bits = 1024 bits 1 Mbit (Megabit) = 2^{10} Kbits (1024 Kbits) 1 Gbit (Gigabit) = 2^{10} Mbits (1024 Mbits) 1 Tbit (Terabit) = 2^{10} Gbits (1024 Gbits)	Conversion table <table> <tr> <th>octal</th> <th>binary</th> </tr> <tr><td>0</td><td>000</td></tr> <tr><td>1</td><td>001</td></tr> <tr><td>2</td><td>010</td></tr> <tr><td>3</td><td>011</td></tr> <tr><td>4</td><td>100</td></tr> <tr><td>5</td><td>101</td></tr> <tr><td>6</td><td>110</td></tr> <tr><td>7</td><td>111</td></tr> </table>		octal	binary	0	000	1	001	2	010	3	011	4	100	5	101	6	110	7	111																																													
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Table of powers of number 2 <table> <tr><td>$2^0 = 1$</td><td></td><td></td></tr> <tr><td>$2^1 = 2$</td><td>$2^9 = 512$</td><td>$2^{-1} = 0,5$</td></tr> <tr><td>$2^2 = 4$</td><td>$2^{10} = 1024$</td><td>$2^{-2} = 0,25$</td></tr> <tr><td>$2^3 = 8$</td><td>$2^{11} = 2048$</td><td>$2^{-3} = 0,125$</td></tr> <tr><td>$2^4 = 16$</td><td>$2^{12} = 4096$</td><td>$2^{-4} = 0,0625$</td></tr> <tr><td>$2^5 = 32$</td><td>$2^{13} = 8192$</td><td>$2^{-5} = 0,03125$</td></tr> <tr><td>$2^6 = 64$</td><td>$2^{14} = 16384$</td><td>$2^{-6} = 0,015625$</td></tr> <tr><td>$2^7 = 128$</td><td>$2^{15} = 32768$</td><td>$2^{-7} = 0,0078125$</td></tr> <tr><td>$2^8 = 256$</td><td>$2^{16} = 65536$</td><td>$2^{-8} = 0,00390625$</td></tr> </table>		$2^0 = 1$			$2^1 = 2$	$2^9 = 512$	$2^{-1} = 0,5$	$2^2 = 4$	$2^{10} = 1024$	$2^{-2} = 0,25$	$2^3 = 8$	$2^{11} = 2048$	$2^{-3} = 0,125$	$2^4 = 16$	$2^{12} = 4096$	$2^{-4} = 0,0625$	$2^5 = 32$	$2^{13} = 8192$	$2^{-5} = 0,03125$	$2^6 = 64$	$2^{14} = 16384$	$2^{-6} = 0,015625$	$2^7 = 128$	$2^{15} = 32768$	$2^{-7} = 0,0078125$	$2^8 = 256$	$2^{16} = 65536$	$2^{-8} = 0,00390625$	Conversion table <table> <tr> <th>hexadecimal</th> <th>binary</th> <th>hexadecimal</th> <th>binary</th> </tr> <tr><td>0</td><td>0000</td><td>8</td><td>1000</td></tr> <tr><td>1</td><td>0001</td><td>9</td><td>1001</td></tr> <tr><td>2</td><td>0010</td><td>A</td><td>1010</td></tr> <tr><td>3</td><td>0011</td><td>B</td><td>1011</td></tr> <tr><td>4</td><td>0100</td><td>C</td><td>1100</td></tr> <tr><td>5</td><td>0101</td><td>D</td><td>1101</td></tr> <tr><td>6</td><td>0110</td><td>E</td><td>1110</td></tr> <tr><td>7</td><td>0111</td><td>F</td><td>1111</td></tr> </table>		hexadecimal	binary	hexadecimal	binary	0	0000	8	1000	1	0001	9	1001	2	0010	A	1010	3	0011	B	1011	4	0100	C	1100	5	0101	D	1101	6	0110	E	1110	7	0111	F	1111
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Tick the programming language which you will use to perform the problems proposed in the topics II and III: ☐ Pascal ☐ C/C++																																																																		

Nr	Item	Score										
Topic I. (25 points)												
1	A storybook consists of 20 pages of text. Each page contains 32 lines; each line has 56 symbols in the <i>extended ASCII</i> code. a) Knowing that a character in the <i>extended ASCII</i> code contains one byte (B), determine and write in the space provided for the answer the total amount of information in KiloBytes (KB) contained in the given book. Write the used formula: _____ Write the calculations: _____ Answer: _____ KB b) The cover of the storybook is a color image with dimensions of 3072x2048 pixels and 32 luminance levels for each of the three basic colors. Determine and write in the space provided for the answer the amount of information contained in the image on the cover. Write the used formula: _____ Write the calculations: _____ Answer: _____ Mbits	L 0 1 2 3 4 5 6 7 8 9	L 0 1 2 3 4 5 6 7 8 9									
2	a) Tick in the list below two correctly written numbers: ☐ (F5, 2G)₁₆ ☐ (953, 47)₁₀ ☐ (296, 75)₈ ☐ (2012, 21)₃ b) Determine the relationship between the numbers in each row of the following table. Write in each of the three cassettes one of the signs <, > or =, which corresponds to their relationship: <table><tr><td>(5EB, 7)₁₆</td><td>☐</td><td>(10111101011, 101)₂</td></tr><tr><td>(634, 65)₈</td><td>☐</td><td>(19C, D4)₁₆</td></tr><tr><td>(185, 25)₁₀</td><td>☐</td><td>(253, 6)₈</td></tr></table> ○ Write the calculations performed to convert both numbers in the second row to the same number system: ○ Write the calculations performed to convert one number in the third row to the number system of the other:	(5EB, 7) ₁₆	☐	(10111101011, 101) ₂	(634, 65) ₈	☐	(19C, D4) ₁₆	(185, 25) ₁₀	☐	(253, 6) ₈	L 0 1 2 3 4 5 6 7 8 9	L 0 1 2 3 4 5 6 7 8 9
(5EB, 7) ₁₆	☐	(10111101011, 101) ₂										
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(185, 25) ₁₀	☐	(253, 6) ₈										

3	Let the logic function be given: $y = \overline{x_1} \vee x_2 \vee \overline{x_1 x_3}$ a) Complete the truth table for the given logical function: <table><tr><th>$x_1 x_2 x_3$</th><th>$\overline{x_1} \vee x_2$</th><th>$\overline{x_1 x_3}$</th><th>y</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table>	$x_1 x_2 x_3$	$\overline{x_1} \vee x_2$	$\overline{x_1 x_3}$	y																																	b) Tick the type of circuit in which the values of the output variables are determined at any time by the combination of the values of the input variables according to the logic functions of the circuit and in which the time parameter does not intervene: ☐ combinational ☐ sequential c) A 4-bit right-to-left shift register is initially in state 0110. Complete the table below with two consecutive states of the given register: <table><tr><th>Time</th><th>d_3</th><th>d_2</th><th>d_1</th><th>d_0</th></tr><tr><td><i>initial</i></td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td><i>t1</i></td><td colspan="4">_____</td></tr><tr><td><i>t2</i></td><td colspan="4">_____</td></tr></table>	Time	d_3	d_2	d_1	d_0	<i>initial</i>	0	1	1	0	<i>t1</i>	_____				<i>t2</i>	_____				<table><tr><td>L</td><td>L</td></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>2</td></tr><tr><td>3</td><td>3</td></tr><tr><td>4</td><td>4</td></tr><tr><td>5</td><td>5</td></tr><tr><td>6</td><td>6</td></tr><tr><td>7</td><td>7</td></tr></table>	L	L	0	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7
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Topic II. (32 points)

Pascal Language Let the following declarations be given: <pre>var t, r : array[0..9] of char; a, b : integer; x, y : real; q : char; w, m : (g, h, c, d, e);</pre> a) The assignment statements are given in the left column of the following table. Tick in the right column the syntactically correct statements: <table><tr><th>Statement</th><th>Correctness</th></tr><tr><td>a := x / b;</td><td>☐</td></tr><tr><td>t := r;</td><td>☐</td></tr><tr><td>x := y mod 5;</td><td>☐</td></tr><tr><td>m := g;</td><td>☐</td></tr><tr><td>w := r;</td><td>☐</td></tr></table>	Statement	Correctness	a := x / b;	☐	t := r;	☐	x := y mod 5;	☐	m := g;	☐	w := r;	☐	b) Write the name of a variable of structured data type from the given declarations: _____ c) Let the following assignments be given: <pre>q := 'B'; x := 14.4; a := 20; b := 6; w := d;</pre> Calculate and write in the space reserved for the answer the value of each of the following expressions: ☐ a mod ord(w) Answer: _____ ☐ a div b * b Answer: _____ ☐ chr(ord(q) + trunc(x / b)) Answer: _____	L 0 1 2 3 4 5 6 7 8 9	L 0 1 2 3 4 5 6 7 8 9
Statement	Correctness														
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C++ Language Let the following declarations be given: <pre>char t[10], r[10]; int a, b; float x, y; char q; enum {g, h, c, d, e} w, m;</pre> a) The assignment statements are given in the left column of the following table. Tick in the right column the syntactically correct statements: <table><tr><th>Statement</th><th>Correctness</th></tr><tr><td>a = x / b;</td><td>☐</td></tr><tr><td>t = r;</td><td>☐</td></tr><tr><td>x = y % 5;</td><td>☐</td></tr><tr><td>m = g;</td><td>☐</td></tr><tr><td>w = r;</td><td>☐</td></tr></table>	Statement	Correctness	a = x / b;	☐	t = r;	☐	x = y % 5;	☐	m = g;	☐	w = r;	☐	b) Write the name of a variable of structured data type from the given declarations: _____ c) Let the following assignments be given: <pre>q = 'B'; x = 14.4; a = 20; b = 6; w = d;</pre> Calculate and write in the space reserved for the answer the value of each of the following expressions: ☐ a % w Answer: _____ ☐ a / b * b Answer: _____ ☐ char(q + int(x / b)) Answer: _____		
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m = g;	☐														
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2

a) We will call **the rank of a digit** its position in the number, from right to left.

Example: Let the number **28395** be given. The rank of the digit **5** is **1**. The rank of the digit **9** is **2**. The highest rank of the digits of the given number is **5**, **the digit with the highest rank is 2**.

The following table presents a sequence of statements in the **Pascal** and **C++ languages** that determine the **digit with the highest rank** of the integer **n** ($1 \leq n \leq 30000$) and **the rank** of this digit:

Pascal language	C++ language
<pre>read(n); rang := 0; while n > 0 do begin rang := rang + 1; c := n mod 10; n := n div 10; end;</pre>	<pre>cin >> n; rang = 0; while (n > 0) { rang++; c = n % 10; n = n / 10; }</pre>

Write in the space provided below a sequence of statements in the language you are studying - **Pascal** or **C++**, replacing the repetitive **while** statement with the repetitive **for** statement, adding other instructions if necessary, so that both sequences produce the same effect:

b) The following table presents a sequence of statements in the **Pascal** and **C++ languages** - that contains nested **if** statements:

Pascal language	C++ language
<pre>if rang = 1 then write('0 <= n < 10') else if rang = 2 then write('10 <= n < 100') else write('n >= 100')</pre>	<pre>if (rang == 1) cout << "0 <= n < 10"; else if (rang == 2) cout << "10 <= n < 100"; else cout << "n >= 100";</pre>

Write in the space provided below in the language you are studying a sequence of statements that will contain a multiple branching operator **case** – in **Pascal language** or **switch** – in **C++ language**, so that both sequences produce the same effect:

L
0
1
2
3
4
5
6
7
8

L
0
1
2
3
4
5
6
7
8

3	As a result of executing of four sequences of statements in Pascal language or C++ language, the values in <i>Table 1</i> (numbered by letters from a to d) were displayed on the screen: <table><tr><th>Letter</th><th>Displayed value</th></tr><tr><td>a</td><td>-3.4563e+003</td></tr><tr><td>b</td><td>-3456.28</td></tr><tr><td>c</td><td>0.003</td></tr><tr><td>d</td><td>2.74e-003</td></tr></table> <i>Table 1</i> <i>Table 2</i> and <i>Table 3</i> contain in the second column sequences of statements in Pascal language and correspondingly in C++ language. The given sequences of statements display on the screen the values as in the right column of <i>Table 1</i>. Task. Table 1 presents four values displayed on the screen, identified by the letters a–d. Table 2 (Pascal language) and Table 3 (C++ language) contain four instruction sequences each. When executed, each sequence displays one of the values presented in Table 1. Write in the „Letter” column of Table 2 or Table 3 (depending on the programming language studied) the letter corresponding to the value displayed by each instruction sequence. Pascal language <table><tr><th>Nr.</th><th>Sequences of statements</th><th>Letter</th></tr><tr><td>1</td><td>x := 0.00273687; write(x:0:3);</td><td></td></tr><tr><td>2</td><td>x := 0.00273687; write(x:10);</td><td></td></tr><tr><td>3</td><td>x := -3456.2796; write(x:5:2);</td><td></td></tr><tr><td>4</td><td>x := -3456.2796; write(x:12);</td><td></td></tr></table> <i>Table 2</i> C++ language <table><tr><th>Nr.</th><th>Sequences of statements</th><th>Letter</th></tr><tr><td>1</td><td>x = 0.00273687; cout << fixed << setprecision(3) << x;</td><td></td></tr><tr><td>2</td><td>x = 0.00273687; cout << scientific <<setw(10)<<setprecision(2)<< x;</td><td></td></tr><tr><td>3</td><td>x = -3456.2796; cout << fixed << setw(5) << setprecision(2) << x;</td><td></td></tr><tr><td>4</td><td>x = -3456.2796; cout << scientific <<setw(12)<<setprecision(4)<< x;</td><td></td></tr></table> <i>Table 3</i>	Letter	Displayed value	a	-3.4563e+003	b	-3456.28	c	0.003	d	2.74e-003	Nr.	Sequences of statements	Letter	1	x := 0.00273687; write (x :0:3);		2	x := 0.00273687; write (x :10);		3	x := -3456.2796; write (x :5:2);		4	x := -3456.2796; write (x :12);		Nr.	Sequences of statements	Letter	1	x = 0.00273687; cout << fixed << setprecision(3) << x ;		2	x = 0.00273687; cout << scientific <<setw(10)<<setprecision(2)<< x ;		3	x = -3456.2796; cout << fixed << setw(5) << setprecision(2) << x ;		4	x = -3456.2796; cout << scientific <<setw(12)<<setprecision(4)<< x ;		L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8
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4	Two friends invented a game: to write all two-digit numbers made up only of odd digits from the set of numbers from 1 to n ($1 \leq n \leq 9$). The winner is the friend who wrote the most such numbers. Task. Write a program that will display all two-digit numbers consisting only of odd digits from the set from 1 to n. Input. The natural number n is read from the keyboard. Output. All two-digit numbers consisting only of odd digits from the set of numbers from 1 to n are displayed on the screen, separated by a space. Example: <table><tr><th>Input</th><th>Output</th></tr><tr><td>4</td><td>11 13 31 33</td></tr></table>	Input	Output	4	11 13 31 33	L 0 1 2 3 4 5 6 7	L 0 1 2 3 4 5 6 7																																				
Input	Output																																										
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Topic III. (30 points)			
1	The following Pascal program is given: <pre>program pr1; var a, b, s : string; nr: integer; function ff(x : char): char; begin ff:= chr(ord(x)+ord('A')-ord('a')); end; procedure fs(w: string; q:integer); var i : integer; begin for i := 1 to q do begin if (w[i]>='0') and (w[i]<='9') then nr := nr + 1; if (w[i]>='a') and (w[i]<='z') then s := s + ff(w[i]); end; end; begin a := 'Abc9Ddlpr7E9'; b := 'Xc5tgW7'; if a > b then fs(a, length(a)) else fs(b, length(b)); write (s , ' ' , nr); end.</pre>	Perform the following tasks for the program pr1: a) Write the names of the global variables used in the procedure fs: _____ b) Underline in the text of the program pr1 the expression that converts lowercase letters to uppercase. c) Write a call to the procedure fs that is executed in the program pr1: _____ d) Tick the type of repetitive statement used in the program pr1: ☐ cycle with initial test ☐ cycle with final test ☐ cycle with counter e) Write what will be displayed as a result of executing the pr1 program: _____	L 0 1 2 3 4 5 6 7

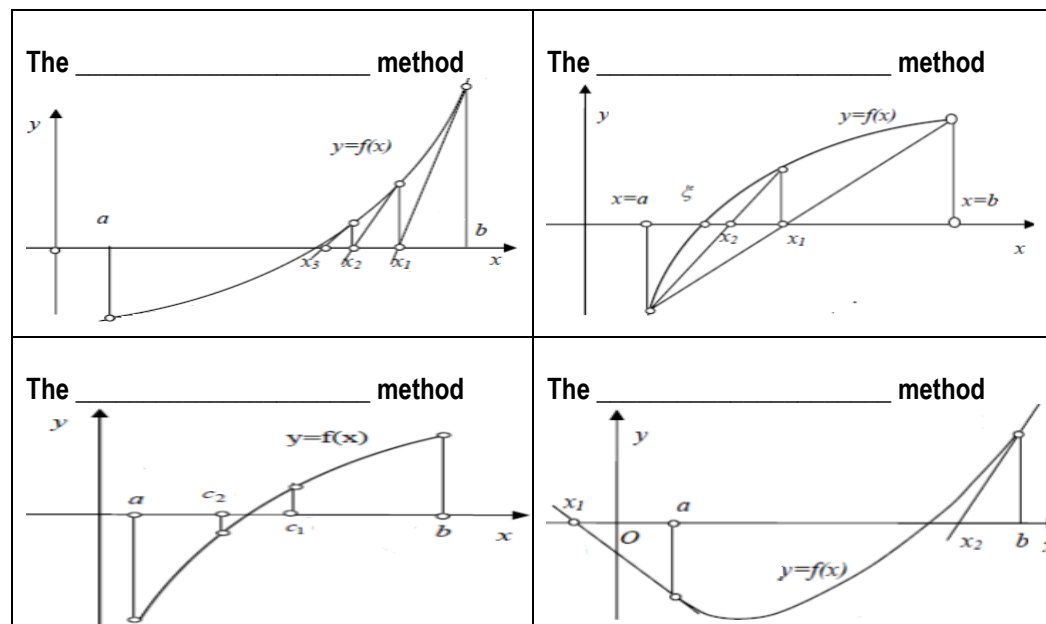
	The following C++ program is given <pre>//program pr1 #include <iostream> #include <string> using namespace std; string a, b, s; int nr; char ff(char x) { return char (x + 'A' - 'a'); } void fs(string w, int q) { int i; for (i = 0; i < q; i++){ if(w[i]>='0' && w[i]<='9') nr++; if(w[i]>='a' && w[i]<='z') s = s + ff(w[i]); } } int main() { a = "Abc9Dd1pr7E9"; b = "Xc5tgW7"; if(a > b) fs(a, a.length()); else fs(b, b.length()); cout << s << ' ' << nr; return 0; }</pre>	Perform the following tasks for the program pr1: a) Write the names of the global variables used in the function fs() : _____ b) Underline in the text of the program pr1 the expression that converts lowercase letters to uppercase. c) Write a call to the function fs() that is executed in the program pr1: _____ d) Tick the type of repetitive statement used in the program pr1: ☐ cycle with initial test ☐ cycle with final test ☐ cycle with counter e) Write what will be displayed as a result of executing the pr1 program: _____															
2	Each of the n classes of a school (both Gymnasium and Lyceum) presented blogs created by the students of the respective class. The classes were given indices from 1 to n. The data on the number of blogs submitted was stored in the two-dimensional table B with two rows and n columns. The elements in the first row and column i are equal to 1 if the class with index i is a Gymnasium class or equal to 2 if the given class is a Lyceum class. The elements in the second row and column i are equal to the number of blogs submitted by the class with index i. Task: Write a program that determines <i>the total number of blogs</i> presented by the n classes and <i>the level of education</i> (Gymnasium or Lyceum) that submitted the most blogs. The program will contain a function named BL, which receives as a parameter an integer - the index of the school level - the value 1 - Gymnasium or 2 - Lyceum. The function will return an integer - the total number of blogs submitted by the students of the respective school level. Input: The text file blog.in contains n+1 lines: on the first line - an integer n ($3 \leq n \leq 35$) - the number of classes; and the next n lines contain two integers each - the first number in line i+1 is equal to 1 or 2, depending on the level of education and the second number represents the number of blogs submitted by students in the class with index i. Output: The text file blog.out contains on the first line an integer - <i>the total number of blogs submitted</i>, and on the second line - a word - GIMNAZIU, if the number of blogs submitted by students in the Gymnasium level is greater than the number of blogs submitted by those in the Lyceum level, or - LICEU - otherwise. Example: <table><tr><th>blog.in</th><th>blog.out</th><th rowspan="5">The solution will be appreciated for: types and variable declarations; operations with the text files; reading and writing data; algorithm organization.</th></tr><tr><td>4</td><td>26</td></tr><tr><td>1 5</td><td>GIMNAZIU</td></tr><tr><td>1 10</td><td>Explanation</td></tr><tr><td>2 7</td><td>5+10 > 7+4</td></tr><tr><td>2 4</td><td>=> GIMNAZIU</td><td></td></tr></table>	blog.in	blog.out	The solution will be appreciated for: types and variable declarations; operations with the text files; reading and writing data; algorithm organization.	4	26	1 5	GIMNAZIU	1 10	Explanation	2 7	5+10 > 7+4	2 4	=> GIMNAZIU		L	L
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1 10	Explanation																
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2 4	=> GIMNAZIU																
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		2	2														
		3	3														
		4	4														
		5	5														
		6	6														
		7	7														
		8	8														
		9	9														
		10	10														
		11	11														
		12	12														
		13	13														
		14	14														
		15	15														
		16	16														

[illegible]

3

a) The table below presents the geometric illustration of some methods for numerically solving algebraic and transcendental equations. Write in the space provided in the cells of the table the name of one of the two methods **the bisection method** or **the chord method**, which correspond to the geometric illustration in the corresponding cell.

Note. Points are awarded if the methods have been correctly entered in no more than two cells.



b) The following table presents programs in **Pascal** and **C++ languages**, that calculate the definite integral of the function $f(x)$ on the segment $[0; 1]$. Some statements in these programs are incomplete.

Write in the spaces provided the missing parts of the statements in the program in the studied language, so that the program calculates the definite integral by **the right rectangle method** for 30 divisions of the integration segment.

Pascal language	C++ language
<pre> program dr; var S, a, b, h : real; i,n:integer; function f(x:real):_____; begin f:=sqr(x)*sqrt(1+3*sqr(x)); end; begin a:=0; b:=1; n:=30; S:=0; h := ____ / n; for i := 1 to n do S:= S + h * f(a + ____); write ('I=',____:6); end.</pre>	<pre> // program dr; #include <iostream> #include <math.h> using namespace std; double S, a, b, h; int i, n; _____ f(double x) { return pow(x,2)*sqrt(1+3*pow(x,2)); } int main() { a = 0; b = 1; n = 30; S = 0; h = ____ / n; for (i = 1; i <= n; i++) S = S + h * f(a + ____); cout << "I=" << ____; return 0; }</pre>

c) In the space provided, write down the mathematical form of the function $f(x)$, the definite integral of which is calculated by the **dr** program: $f(x) =$ _____

L
0
1
2
3
4
5
6
7L
0
1
2
3
4
5
6
7

Topic IV. (13 points)

- 1 A database was created in MS Access. Fragments of the content of the database tables are presented in *Image 1*:

Clienți				Numere_tel		
id_client	Nume	Prenume	Bonus	Id_tel	Id_client	Numar
c001	Lupu	Calin	☒	t001	c002	068456745
c002	Lacatus	Ioana	☐	t002	c003	079457890
c003	Pelin	Laurentiu	☐	t003	c001	022523456
c004	Padure	Sorina	☒	t004	c002	022677777
c005	Andronachi	Elena	☒	t005	c004	069232334
c006	Oprea	An	☐	t006	c002	079556788

Comunicari				
id_com	Id_tel	Serviciu	Data	Minute
1	t001	Roaming	5/16/2026	50
2	t002	Gaming	4/15/2026	100
3	t005	Wi-Fi PLUS	6/3/2026	75
4	t003	Roaming	11/29/2025	70
5	t001	Canale TV	10/12/2025	180
6	t001	SMS Service	5/22/2026	30

Image 1

Based on the content of the table fragments:

- a) Fill in the *Image 2* all the necessary elements, including the relations between the tables, to define in **Design View** an update query that:
- will select four fields - *Numar*, *Data*, *Bonus* and *Minute*;
 - will display three fields - *Numar*, *Data* and *Minute*;
 - will add 40 minutes (*Minute* field) for loyalty to customers who have a bonus (*Bonus* field) in 2026 (*Data* field).

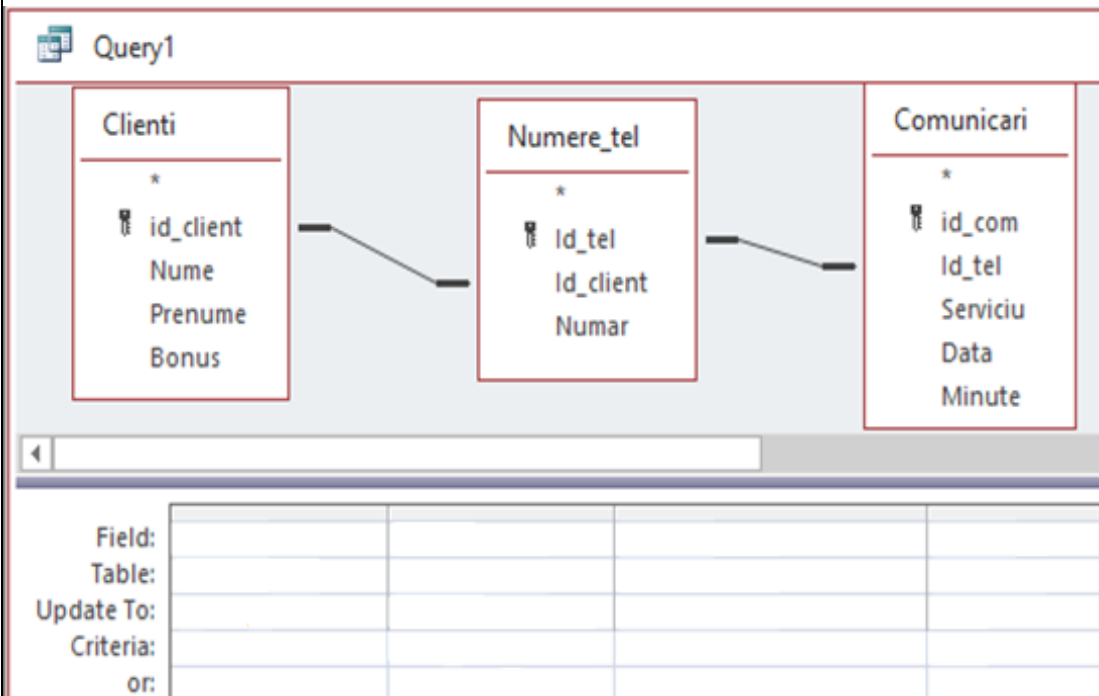


Image 2

- b) Write the name of a field in the *Comunicări* table that is a foreign key: _____
- c) Write the name of a field in the given database that can have the *Autonumber* type: _____