Applied mathematics and artificial intelligence: Second-round sample tasks for the Open Doors undergraduate track

You will be asked to complete 36 tasks, including:
- 22 entry-level tasks, each correct answer worth 1 point;
- 11 intermediate-level tasks, each correctly answered task worth 4 points;
- 3 advanced tasks (constructed response), each correctly completed task valued at 11-12 points.

Evaluation criteria and standard answers are provided for the advanced tasks requiring constructed responses.

Mathematical logic

Task 1
Entry level (1 point)

Which statement is logically equivalent to the statement $\overline{A \Rightarrow (B \vee C)}$?

a) $A \wedge \overline{B} \wedge \overline{C}$
b) $\overline{A} \wedge \overline{B} \wedge \overline{C}$
c) $A \wedge (\overline{B} \vee \overline{C})$
d) $\overline{A} \wedge (B \vee C)$

Answer: a

Task 2
Entry level (1 point)

Tanya is younger than Vika but older than Sonya. Katya is older than Tanya but younger than Vika. Anya is older than Tanya but younger than Vika. Two of these girls are the same age. Name the girls of the same age, the youngest and the oldest girl.

a) Tanya and Anya are the same age. The youngest is Katya, and the oldest is Vika.
b) **Katya and Anya are the same age. The youngest is Sonya, and the oldest is Vika.**
c) Sonya and Anya are the same age. The youngest is Katya, and the oldest is Vika.
d) Katya and Anya are the same age. The youngest is Tanya, and the oldest is Vika.

Answer: b

Task 3
Entry level (1 point)

Identify an equation that has no solutions:

a) $x^2 - 5x - 7 = 0$
b) $3^x = \sqrt{2} - 2$
c) $\log_2(2x+3) = -\pi$
d) $\cos x = 0.7$

Answer: b

Task 4
High level (12 points)

All five-digit natural numbers in decimal notation are considered.

1. How many five-digit natural numbers are there that contain only various odd digits?
2. How many five-digit natural numbers are there that contain only odd digits?
3. Find the sum of all five-digit natural numbers made up of odd digits.
4. Find the probability that a randomly selected five-digit natural number will contain only odd digits.

Attention: during the assessment, the progress of the solution will be taken into account; only the answer without a solution will not be taken into account.

Solution:

1. There are five odd digits in total: 1, 3, 5, 7, 9. Therefore, the number of five-digit natural numbers, in the notation of which only various odd digits are present, coincides with the number of permutations without repetitions of 5 elements. The number of such numbers is 5! = 120.
2. The number of five-digit numbers, the recording of which contains only odd digits, coincides with the number of placements with repetitions of 5 elements of 5. The number of such numbers is $5^5 = 3125$.
3. 1st method. Consider all five-digit odd numbers and first find the sum of digits that are in the unit digit. Each of the odd digits in the unit digit occurs as many times as there are four-digit numbers with only odd digits, that is, $5^4 = 625$ times. Then the sum of the digits in the units place of all five-digit numbers that are made up of odd digits is equal to 625 ·(1 + 3 + 5 + 7 + 9) = 625 ·25 = 15 625. Similarly, the sum of the digits in the tens, hundreds place, thousands and tens of thousands, is equal to 15,625. Then the sum of all five-digit numbers made up of odd digits is equal to 15,625 ·(1+10+100+1000+10,000) = 15,625 ·11,111 = 173,609,375.

2nd method. Pairs of odd digits 3 and 7, 1 and 9 are symmetrical with respect to the number 5. Consider a five-digit number composed of odd digits $\overline{a_4a_3a_2a_1a_0} = a_4 \cdot 10^4 + a_3 \cdot 10^3 + a_2 \cdot 10^2 + a_1 \cdot 10 + a_0$, where a_0, a_1, a_2, a_3, *and* $_4$ are odd digits. Then for i = 0,1,2,3,4 digit 10 – *and* $_i$ is odd. If the given number is not equal to 55,555, then the number

$\overline{(10-a_4)(10-a_3)(10-a_2)(10-a_1)(10-a_0)} = (10-a_4)\cdot 10^4 + (10-a_3)\cdot 10^3 + (10-a_2)\cdot 10^2 + (10-a_1)\cdot 10 + (10-a_0)$ is composed of odd digits and symmetrical to the number $\overline{a_4a_3a_2a_1a_0}$ relative to 55,555. Therefore, all five-digit numbers made up of odd digits can be divided into pairs that are symmetrical relative to the number 55,555 (there will be no pair for the number 55,555). The number of five-digit numbers, the recording of which contains only odd digits, is equal to 3125 (see solution to point 2), then pairs of numbers that are symmetrical with respect to 55,555 will be (3125 – 1)/2 = 1562. The sum of the numbers in each pair will be equal to $\overline{(10-a_4)(10-a_3)(10-a_2)(10-a_1)(10-a_0)} + \overline{a_4a_3a_2a_1a_0} = 10\cdot 10^4 + 10\cdot 10^3 + 10\cdot 10^2 + 10\cdot 10 + 10 =$ =111 110. Then the sum of all five-digit numbers made up of odd digits is 1562 ·111 110 + 55 555 = 173 609 375.

4. The total number of five-digit numbers is 99,999 – 9,999 = 90,000, and the number of five-digit numbers containing only odd digits is 3125 (see solution to point 2). Then the probability that a randomly selected five-digit number will contain only odd digits is equal to $\frac{3125}{90000} = \frac{5}{144}$.

Answer: 1) 120; 2) 3125; 3) 173 609 375; 4) $\frac{5}{144}$

Evaluation criteria:

Question number	Criterion	point
1	The number of five-digit natural numbers whose notation contains only various odd digits has been reasonably correctly found.	2
	An incorrect answer to the first question of the problem was received due to a computational error, but it was indicated that you need to find the number of permutations without repetitions of five elements.	1
	The solution to the first question does not meet any of the listed criteria	0
2	The number of five-digit natural numbers containing only odd digits was found to be reasonably correct.	3
	An incorrect answer was received to the second question of the problem due to a computational error, but it was indicated that you need to find the number of placements with repetitions of 5 elements of 5	1
	The solution to the second question does not meet any of the listed criteria	0
3	The sum of all five-digit natural numbers composed of odd digits has been reasonably correctly found.	5
	An incorrect answer was received to the third question of the problem due to a computational error.	3
	The correct answer to the third question of the problem was received, but it was not justified why this sum can be found in the indicated way (for the first method of solving why each odd digit in the digit occurs 625 times, for the second method of solving why all numbers except one are divided into pairs with equal amounts or a similar situation)	2
	The amount was not found, but the solution indicates the correct approach to calculating the amount (using the algorithm specified in the work, you can find the correct value of the amount)	1
	The solution to the third question does not meet any of the listed criteria	0
4	The correct answer to the fourth question of the problem was reasonably obtained.	2
	An incorrect answer was received due to a computational error, but it was indicated that the probability can be found using the classical definition of probability, and the number of all five-digit natural numbers and the number of five-digit natural numbers made up of odd digits were correctly found	1

	The solution to the fourth question does not meet any of the listed criteria	0
The maximum score for the Question		12

Mathematics

Task 5
Entry level (1 point)

Solve the inequality $\frac{x^2+5x+6}{x^2+3x+2} < 0$

a) $(-3;\ -2) \cup (-2;\ -1)$
b) $(-\infty;\ -3) \cup (-2;\ -1)$
c) $(-3;\ -1)$
d) $(-\infty;\ -3) \cup (-1;\ +\infty)$

Answer: a

Task 6
Entry level (1 point)

Find the smallest positive root of the equation $\sin(\pi x) = \frac{1}{2}$

a) $\frac{5}{6}$
b) $\frac{1}{6}$
c) $\frac{\pi}{6}$
d) $\frac{1}{2}$

Answer: b

Task 7
Intermediate level (4 points)

Find the value of the expression $\frac{\cos 2x}{\sin x \cdot \cos x + \sin^2 x} - \cot x$

Answer: -1

Task 8
Intermediate level (4 points)

Find the integer solution to the inequality $\log_{\frac{2}{3}}\left(x^2 - \frac{11x}{2} + \frac{15}{2}\right) > -1$.

Answer: 2

Mathematical physics

Task 9
Entry level (1 point)

The distance s (in meters) to the location of a lightning strike can be approximately calculated using the formula $s = 330\,t$, where t is the number of seconds that passed between the flash of lightning and the clap of thunder. Determine at what distance the observer is from the location of the lightning strike if $t = 14$ s. Give your answer in kilometres, rounded to the nearest integer number.

a) 4
b) 46
c) 5
d) 4620

Answer: c

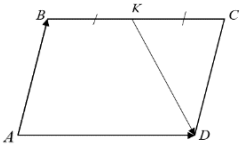
Task 10
Entry level (1 point)

Find the ordinate of the intersection point of the graphs of the functions
$y = |2x - 3|$ and $y = -2x + 5$

a) 2
b) 1
c) 0.5
d) -2

Answer: b

Task 11
Entry level (1 point)

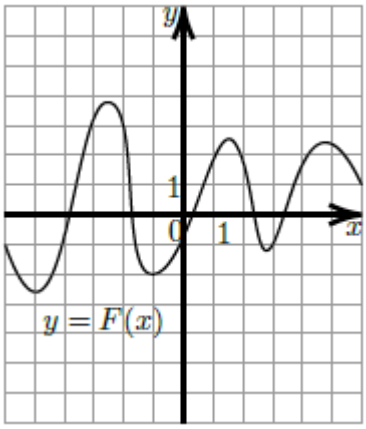


In parallelogram $ABCD$, point K is the midpoint of side BC. Express the vector $\overrightarrow{KD}$ in terms of the vectors $\overrightarrow{AB}$ and $\overrightarrow{AD}$.

a) $\overrightarrow{KD} = \frac{1}{2}\overrightarrow{AB} - \overrightarrow{AD}$
b) $\boldsymbol{\overrightarrow{KD} = \frac{1}{2}\overrightarrow{AD} - \overrightarrow{AB}}$
c) $\overrightarrow{KD} = \overrightarrow{AD} - \overrightarrow{AB}$
d) $\overrightarrow{KD} = \frac{1}{2}\overrightarrow{AD} + \overrightarrow{AB}$

Answer: b

Task 12
Intermediate level (4 points)



The figure shows a graph of a function $y = F(x)$ one of the antiderivative functions $f(x)$ defined on the interval $[-6, 6]$. Find the number of solutions to the equation $f(x) = 0$ on the interval $(-3, 3)$.

Answer: 4

Applied mathematics

Task 13
Entry level (1 point)

Trousers are 30% more expensive than a shirt and 22% cheaper than a jacket. How much per cent is a shirt cheaper than a jacket?

a) 52%
b) 8%
c) 40%
d) 26%

Answer: Answer c

Task 14
Entry level (1 point)

Find the maximum point of the function $y = \sqrt{4x - x^2 - 3}$

a) 1
b) 2
c) -2
d) 4

Answer: Answer b

Task 15
Intermediate level (4 points)

The legs of a regular triangle are 3 and 4. Find the radius of the circle inscribed in this triangle.

Answer: 1

Task 16
High level (11 points)

A regular triangle is given, and the lengths of the legs of this triangle are expressed in irrational numbers.

1. Can the area of such a triangle be a rational number?
2. Can both the area and perimeter of such a triangle be rational numbers?
3. Can the area, the sum of the lengths of the legs, and the length of the bisector drawn from the vertex of a right angle of such a triangle be rational numbers?

Attention: During the assessment, the progress of the solution will be considered; only the answer without a solution will not be considered.

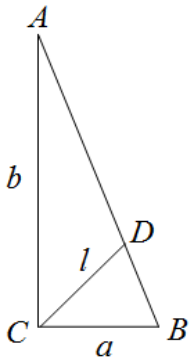
Solution:

Let a and b be the lengths of the legs, c the length of the hypotenuse, S the area of the triangle, P – triangle perimeter, *and* l is the length of the bisector drawn from the vertex of a right angle.

1. It can. Let's give an example. Let $a=\sqrt{2}$, $b=2\sqrt{2}$, a, b be irrational numbers. Then it $S=\frac{1}{2}ab=\frac{1}{2}\cdot\sqrt{2}\cdot 2\sqrt{2}=2$ is a rational number.

2. They can. Let's give an example. Let $a=5-\sqrt{7}$, $b=5+\sqrt{7}$, a, b be irrational numbers. Then it $S=\frac{1}{2}ab=\frac{1}{2}\cdot\left(5-\sqrt{7}\right)\cdot\left(5+\sqrt{7}\right)=9$ is a rational number. According to the Pythagorean theorem $c=\sqrt{a^2+b^2}=\sqrt{\left(5-\sqrt{7}\right)^2+\left(5+\sqrt{7}\right)^2}=\sqrt{2\cdot(25+7)}=8$, $P=a+b+c=\left(5-\sqrt{7}\right)+\left(5+\sqrt{7}\right)+8=18$ is a rational number.

3. Can not. Let, by contradiction, there exist irrational a, b such that S, $a+b$ and l are rational numbers. Consider ΔABC with right angle C, $AC=b$, $CB=a$. Let us draw the bisector CD, $CD=l$. $S=\frac{1}{2}ab$ is a rational number by assumption. On the other hand, $S=S_{ACD}+S_{BCD}$. $\angle ACD=\angle BCD=45$, since CD is the bisector of right angle $S_{ACD}=\frac{1}{2}AC\cdot CD\cdot\sin\angle ACD\ C$, $S_{DCD}=\frac{1}{2}BC\cdot CD\cdot\sin\angle BCD$, Then $S=\frac{1}{2}al\sin 45^\circ+\frac{1}{2}bl\sin 45^\circ=\frac{1}{2}l(a+b)\sin 45^\circ=\frac{1}{4}l(a+b)\cdot\sqrt{2}$.



Equality $S=\frac{1}{4}l(a+b)\cdot\sqrt{2}$ is impossible, since S is a rational number by assumption, and $\frac{1}{4}l(a+b)\cdot\sqrt{2}$ is an irrational number as the product of a rational number $\frac{1}{4}l(a+b)$ ($a+b$ and l are rational numbers by assumption) by an irrational number $\sqrt{2}$.

Answer: 1. It can. 2. They can. 3. They can't.

Evaluation criteria:

Question number	Criterion	point

1	An example of a regular triangle that satisfies the conditions of the problem is given, and it is shown that for the given example the area is a rational number	3
	An example of a regular triangle that satisfies the conditions of the problem is given, and it is shown that for the given example the area is a rational number, but a computational error was made	2
	An example of a regular triangle is given that satisfies the conditions of the problem, but it is not shown that for the given example the area is a rational number	1
	The solution to the first question does not meet any of the listed criteria	0
2	An example of a regular triangle that satisfies the conditions of the problem is given, and it is shown that for the given example the area and perimeter are rational numbers	4
	An example of a regular triangle that satisfies the conditions of the problem is given, and it is shown that for the given example the area and perimeter are rational numbers, but a computational error was made	2
	An example of a regular triangle is given that satisfies the conditions of the problem, but it is not shown that for the given example the area and perimeter are rational numbers	1
	The solution to the second question does not meet any of the listed criteria	0
3	It has been proven that there is no regular triangle with irrational legs that satisfies the conditions of the third question of the problem.	4
	It has been proven that there is no regular triangle with irrational legs that satisfies the conditions of the third question of the problem, but during the proof, a computational error was made that does not affect the logic of reasoning	3
	When proving that there is no regular triangle with irrational legs that satisfies the conditions of the third question of the problem, one of the unimportant cases was missed.	2
	When proving that there is no regular triangle with irrational legs that satisfies the conditions of the third question of the problem, one of the essential cases was missed.	1
	The solution to the third question does not meet any of the listed criteria	0
Maximum score for the task		11

Statistics & probability

Task 17
Entry level (1 point)

A discrete random variable is specified by a probability distribution table:

x_i	1	3	7	8
p_i	0 .1	0.4	p	0.15

Find the value of p.

a) 0.7
b) 0.25
c) 0.3
d) 0.35

Answer: d

Task 18
Entry level (1 point)

There are 4 textbooks on probability theory and 3 textbooks on geometry randomly placed on the bookshelf. What is the probability that all books on the same subject will be next to each other?

a) $\mathbf{\frac{2}{35}}$
b) $\frac{1}{35}$
c) $\frac{4}{7}$
d) $\frac{3}{7}$

Answer: a

Task 19
Intermediate level (4 points)

In the store, two identical machines sell coffee. The probability that the machine will run out of coffee at the end of the day is 0.25. The probability that both machines will run out of coffee is 0.15. Find the probability that there will be coffee left in both machines at the end of the day.

Answer: 0.65

Task 20
Intermediate level (4 points)

The device consists of six elements connected in parallel and operating independently. The probability of each element operating without failure during time t is 0.6. For the device to operate without failure, it is sufficient for at least one element to function. What is the probability that the equipment will work without failure during time t? Round your answer to the nearest thousand.

Answer: 0.996

Computer science, information systems

Task 21
Entry level (1 point)

Convert 512 bits to a suitable dimension.

a) 0.5 kilobytes;
b) 64 bytes;
c) 256 bytes;
d) 50 bytes.

Answer: b

Task 22
Entry level (1 point)

What is the smallest integer value of X for which the expression is true
$$(-2 \le X + 5 < 7) \wedge \neg(X \cdot X \ge 49)\,?$$

a) –7
b) –6
c) 1
d) 2

Answer: b

Task 23
Intermediate level (4 points)

Among the numbers 100_{10}, 90_{10}, and 80_{10} find the number whose binary notation has the smallest number of ones. In your answer, write down the number of ones in binary notation for this number.

Answer: 2

Task 24
Intermediate level (4 points)

The algorithm for calculating the value of the function *F(n)* , where *n* is a natural number, is given by the following relations:
F(n) = *n* , for *n* < 11;
F(n) = *n* + *F* (*n* − 1), if *n* ≥ 11.
What is the value of the expression *F* (2024) − *F* (2021)?

Answer: 6069

Computer science, artificial intelligence

Task 25
Entry level (1 point)

Artificial intelligence is...

a) A cyber-mechanical device, half human, half machine. Underneath it is a hyperalloy combat chassis controlled by a microprocessor, fully armored, and very strong. But on the outside is living human tissue: flesh, skin, hair, and blood, designed for cyborgs.

b) Artificial neural network capable of learning and self-learning.
c) A set of software or hardware and software that simulates human cognitive abilities.
d) A program capable of self-awareness and independent thought.

Answer: c

Task 26
Entry level (1 point)

In one of the Unicode encodings, each character is encoded using 16 bits. Find the size in bytes of the following sentence in the given encoding:
Слух обо мне пройдет по всей Руси великой.

a) 102
b) 672
c) 51
d) 84

Answer: a

Task 27
Intermediate level (4 points)

In the query language of search engines, the symbol "|" is used for the logical operation "OR" and the symbol "&" for the logical operation "AND". The table shows the queries and the number of pages found for a specific segment of the Internet.

Request	Pages found (in thousands)
Battleship | Corvette	3320
Battleship & Corvette	1300
Battleship	2100

How many pages (in thousands) are found for the query Corvette?
It is considered that all queries were executed almost simultaneously, so the set of pages that contain all the searched words did not change during the time the queries were executed.

Answer: 2520

Task 28
High level (11 points)

In a tree, the degree of each vertex is either 1 or 4. The number of vertices of degree 4 is 50. Each vertex of degree 4 is connected to either two or three vertices of degree 1. Vertices of degree 4 that are connected to two vertices of degree 1 are called strong, and vertices of degree 4 that are connected to three vertices of degree 1 are called weak.
1. How many vertices are there in such a tree?
2. Find the number of weak vertices of the tree.
3. Let the length of each edge be 1. Find the length of the shortest path between two weak vertices.

Attention: during the assessment, the progress of the solution will be taken into account; only the answer without a solution will not be taken into account.

Solution:

1. Let us denote n as the number of vertices of the tree, m as the number of edges. According to the handshake theorem, the sum of the degrees of all vertices in a graph is equal to $2m$. There are 50 vertices of degree 4 in this tree, and $n - 50$ vertices of degree 1. This means that the sum of all degrees is $4 \cdot 50 + 1 \cdot (n - 50) = n + 150$. Thus,

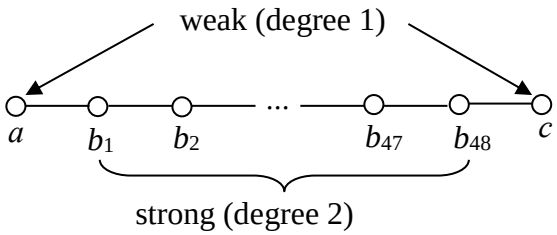
$$n + 150 = 2m \qquad (1)$$

Note that in any tree $m = n - 1$. Substituting this into (1), we get the equation $n + 150 = 2n - 2$. Solving the equation, we get $n = 152$.

2. Let's remove all vertices of degree 1 from the tree. The resulting graph T' is also a tree, the number of vertices of which is 50, and the number of edges is 49. Thus, each strong vertex has had 2 neighbours removed and the degrees of all such vertices in T' are equal to 2. Weak vertices have 3 neighbors removed and their degree becomes equal to 1.

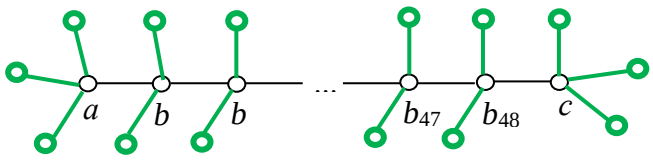
Let's denote the number of weak vertices as x. Then the number of strong ones is equal to $50 - x$ and the sum of all degrees of the tree T' is equal to $2(50 - x) + x = 100 - x$, which in turn is equal to twice the number of vertices, that is, $100 - x = 2 \cdot 49 = 98$ and therefore $x = 2$.

3. Let's consider the tree T' from point 2. Two of its vertices are weak and have degree 1 (hence, we need to find the shortest path between them), and the rest have degree 2. Consider one of the vertices of degree 1, and denote it as a. Let it be connected by an edge to vertex b_1. Let us show that the vertex b_1 has degree 2. Indeed, if b_1 has degree 1, then none of the other vertices are adjacent to either a or b_1, and, therefore, the graph is not connected and, therefore, is not a tree. Thus, b_1 has degree 2. Let's denote the neighbour of b_1 that is different from a as b_2. Reasoning similarly, we conclude that the vertex b_2 also has degree 2. Then we further conclude that b_2 is adjacent to b_3 of degree 2, b_3 is adjacent to b_4 of degree 2, ..., b_{47} is adjacent to b_{48} of degree 2. Since there are no other vertices of degree 2 except b_1, ..., b_{48}, the second neighbour of b_{48} can only be the second vertex of degree 1 (we denote it as c).



graph T′

So, the tree T' is a chain from a to c, passing sequentially through b_1, b_2, ..., b_{48}. The only (and therefore the shortest) path between a and c consists of edges (a, b_1), (b_1, b_2), ..., (b_{47}, b_{48}), (b_{48}, c) and, therefore, has a length of 49.



source tree

Answer: 1) 152; 2) 2; 3) 49

Evaluation criteria:

Question number	Criterion	points
1	The number of vertices of a given tree is reasonably correctly found	3
	An incorrect answer to the first question of the problem was received due to a computational error, but it was indicated that the number of edges of the tree is 1 less than the number of vertices and the handshake theorem was mentioned	2
	Only the handshake theorem is mentioned without further progress, or an example of a tree with the specified characteristics is constructed and the number of vertices in it is counted (correctly), while the structure of the tree is found incorrectly or there is no justification that it is unique.	1
	The solution to the first question does not meet any of the listed criteria	0
2	The number of weak vertices of a given tree is reasonably correctly found	4
	An incorrect answer was received to the second question of the problem due to a computational error, but the solution contains the idea of considering a tree obtained from the original one by removing vertices of degree 1	2
	A correct example of a tree with the specified characteristics has been constructed and the number of weak vertices in it has been correctly calculated, but there is no justification that the structure of the tree is the only possible one	1
	The solution to the second question does not meet any of the listed criteria	0
3	The distance between the weak vertices of this graph is reasonably correctly found	4
	An incorrect answer to the third question of the problem was obtained, but it was correctly substantiated that the tree T' is a chain with ends at weak vertices	2
	An example of a tree with the specified characteristics has been constructed and the distance between weak vertices has been calculated (correctly), but there is no justification that the structure of the tree is the only possible one	1
	The solution to the third question does not meet any of the listed criteria	0
Maximum score for the task		11

Computer science, cybernetics

Task 29
Entry level (1 point)

What number should stand in the equation $19_{16} \cdot 100_2 + 1 * 1_8 = 197_{10}$ in place of the asterisk?

a) 2
b) 4
c) 0
d) 6

Answer: b

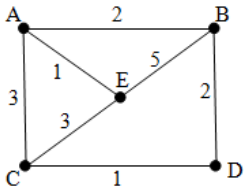
Task 30
Entry level (1 point)

The table shows the cost of transportation between five railway stations, designated by the letters A, B, C, D, and E.

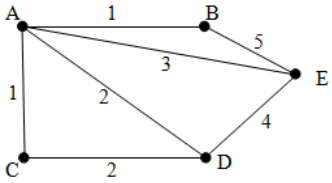
	A	B	C	D	E
A		1	1	2	3
B	1				5
C	1			2	
D	2		2		4
E	3	5		4	

Provide a graph that matches the table.

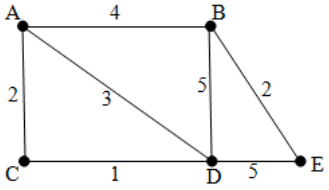
a)



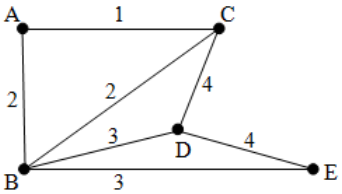
b)



c)



d)



Answer: b

Task 31
Entry level (1 point)

Given is a program fragment that processes an array A of 10 elements:

BASIC

```
j = 1
FOR i = 1 TO 10
IF A( i ) = A(j) THEN
j = i
ENDIF
NEXT i
s = j
```

Python

```
j = 1
for i in range(1, 11):
if A[ i ] == A[j]:
j = i
s = j
```

Algorithmic language

```
j : = 1
begin cycle for i from 1 to 10
  if A[ i ] = A[j] then
j := i
  end if
End cycle
s := j
```

Pascal

```
j := 1;
for i := 1 to 10 do
if A[ i ] = A[j] then j := i ;
s := j;
```

C++

```
j = 1;
for ( i = 1; i <= 10; i ++)
if (A[ i ] == A[j])
{
j = i ;
}
s = j;
```

What will the value of the variable s be after executing this algorithm?

a) the value of the variable s is 1
b) the value of the variable s is 10
c) the value of the variable s is equal to the index of the element that is equal to the first one and that has the highest index
d) the value of the variable s is equal to the index of the element that is equal to the last one and that has the smallest index

Answer: c

Task 32
Intermediate level (4 points)

The Gamma executor has two teams, which are assigned numbers:
1. add 3;
2. multiply by b
(*b* is an unknown natural number; $b \geq 2$).
By executing the first one of them, Gamma increases the number on the screen by 3, and by executing the second, it multiplies this number by *b*. The program for the Gamma executor is a

sequence of command numbers. It is known that program 11211 converts the number 1 to the number 97. Determine the value of *b*.

Answer: 13

Computer science, software engineering

Task 33
Entry level (1 point)

Arkady, Boris, Vladimir, Grigory and Dmitry shook hands when they met (each shook hands with each other once). How many handshakes were done?

a) 5
b) 6
c) 8
d) 9
e) 10

Answer: e

Task 34
Entry level (1 point)

The article, typed on a computer, contains 20 pages, each page has 40 lines, and each line has 48 characters. In one representation of Unicode, each character is encoded as two bytes. Determine the information size of the article in kilobytes in this Unicode representation variant.

a) 76800
b) 76.8
c) 37.5
d) 75

Answer: d

Task 35
Entry level (1 point)

Logical expression value: (A∧ ¬A) ∨(A ∨A) with the TRUE value of A is equal to

a) TRUE
b) LIE
c) 0
d) Insufficient source data

Answer: a

Task 36
Intermediate level (4 points)

Executor The Editor receives a string of digits as input and converts it. The Editor can execute two commands, in both commands *v* and *w* denote chains of digits.
A) **replace** (v, *w*).
This command replaces the first left occurrence of the string *v* in a line with the string *w*. For example, running the **replace** (111, 27) command will convert the string 05111150 to string 0527150.
If there are no occurrences of *v* in a string, then executing the **replace** (v, *w*) command does not change that string.
B) **found** (v).
This command checks whether the string *v* occurs in the Editor's line. If it is encountered, the command returns the boolean value “true”, otherwise it returns the value “false”. The executor's line does not change.

Cycle
WHILE condition
sequence of commands
END WHILE
is executed as long as the condition is true.

What string will be produced by applying the following program to a string of 98 ones?
START
WHILE found (1111)
replace (1111, 22)
replace (222, 1)
END WHILE
END

Answer: 1 2