

## Computer and Data Science: Second-round Sample Tasks for the Open Doors Master's and Doctoral Track

This sample test comprises 35 tasks, including: 21 entry-level tasks with a single correct answer, each correct answer assigned 1 point; 0 intermediate-level tasks with multiple correct answers, each correct answer is assigned 3 points; 1 intermediate-level task requiring a detailed answer assigned up to 5 points, depending on its correctness and completeness; 3 advanced-level tasks requiring a detailed answer, each answer assigned up to 15 points, depending on its correctness and completeness.

For advanced-level tasks requiring a detailed answer, assessment criteria and a standard answer are provided.

### Field of Science 1. Applied Mathematics

#### Task 1 Entry level (1 point)

Select the string that matches the POSIX Extended regular expression  $/^{\wedge}[\mathbf{abc}]^+[\mathbf{a-zA-Z}]^?8\{3\}/$ .

- a) aaFDF888
- b) aaF888
- c) xzyaaR888
- d) aaR8

**Answer: b.**

#### Task 2 Entry level (1 point)

What is the weight of the minimum spanning tree if the graph is given by an adjacency matrix:

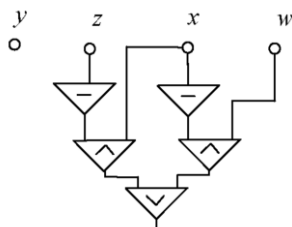
$\{0,1,1,0,11,0,0,1,01,0,0,1,10,1,1,0,11,0,1,1,0\}$ ,

- a) 2
- b) 3
- c) 4
- d) 1

**Answer: c.**

#### Task 3 Entry level (1 point)

To which Boolean function does this scheme of functional elements correspond?



- a)  $xw \vee xz$
- b)  $\underline{xy} \vee \underline{wz}$
- c)  $\underline{xw} \vee \underline{xz}$
- d)  $\underline{xw} \vee \underline{xz}$

**Answer: d.**

**Task 4**  
**Intermediate level (3 points)**

Which of the following functions is in disjunctive normal form (DNF)?

- a)  $f(x, y, z) = x \wedge x \oplus x \wedge y \wedge z$
- b)  $f(x, y, z) = (x \vee \underline{x}) \wedge (x \vee y \vee z) \wedge (y \vee x)$
- c)  $f(x, y, z) = x \wedge y \vee \underline{x} \wedge \underline{y} \wedge z$
- d)  $f(x, y, z) = x \vee y \vee z$

**Answer: c, d.**

**Task 5**  
**Intermediate level (3 points)**

For which sets A and B does  $|A \cup B| = 5$ ?

- a)  $A = \{1, 2, 3\}$   $B = \{1, 6, 7, 2\}$
- b)  $A = \{1, 2, 3\}$   $B = \{1, 6\}$
- c)  $A = \{1, 2, 3\}$   $B = \{6, 7\}$
- d)  $A = \{1, 2, 3\}$   $B = \{1, 2\}$

**Answer: a, c.**

**Task 6**  
**Advanced level (15 points)**

Transform the function  $F(x_1, x_2, x_3, x_4) = 1001001010101100$ , using the formula of disjunctive decomposition over a set of variables  $x_1, x_2$ . Provide the resulting functions for the variables  $x_3, x_4$ , using a set of basic Boolean operations—NOT, OR, and AND.

**Note:** A complete solution must include your method and reasoning. Providing the final answer alone will not suffice.

**Solution:**

Using the disjunctive decomposition formula for two variables, we obtain:

$$\begin{aligned}
 F(x_1, x_2, x_3, x_4) &= \bigvee_{(a_1, a_2)} x_1^{a_1} \cdot x_2^{a_2} \cdot f_{1..4}(a_1, a_2, x_3, x_4) \\
 &= \bigvee_{(0,0)(0,1)(1,0)(1,1)} x_1^{a_1} \cdot x_2^{a_2} \cdot f(a_1, a_2, x_3, x_4) \\
 &= x_1^0 \cdot x_2^0 \cdot f_1(0,0, x_3, x_4) \vee x_1^0 \cdot x_2^1 \cdot f_2(0,1, x_3, x_4) \vee x_1^1 \cdot x_2^0 \cdot f_3(1,0, x_3, x_4) \vee x_1^1 \\
 &\quad \cdot x_2^1 \cdot f_4(1,1, x_3, x_4) \\
 &= \underline{x_1} \cdot \underline{x_2} \cdot f_1(0,0, x_3, x_4) \vee \underline{x_1} \cdot x_2 \cdot f_2(0,1, x_3, x_4) \vee x_1 \cdot \underline{x_2} \cdot f_3(1,0, x_3, x_4) \vee x_1 \\
 &\quad \cdot x_2 \cdot f_4(1,1, x_3, x_4)
 \end{aligned}$$

(A correct formulation of the disjunctive decomposition formula for the given variables is worth 5 points.)

Let us determine the values of the functions  $f_1, f_2, f_3$ , and  $f_4$  on each set by using the values from corresponding sets of the original function  $F$  (you may use the truth table or Karnaugh map below for visual comparison). For example, in the first column, we successively determine

$$\begin{aligned}
 f_1(0000) &= 1, \\
 f_1(0001) &= 0,
 \end{aligned}$$

$f_1(0010) = 0$ ,  
 $f_1(0011) = 1$ ; we also determine the functions  $f_{2-4}$ .

Truth table for the function F

$x_1$	$x_2$	$x_3$	$x_4$	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Karnaugh map for F

$x_1 x_2$ $x_3 x_4$	00	01	11	10
00	1	0	1	0
01	0	0	0	1
11	1	1	0	0
10	1	0	0	1

$x_3$	$x_4$	$f_1(0,0,x_3,x_4)$	$f_2(0,1,x_3,x_4)$	$f_3(1,0,x_3,x_4) \vee$	$f_4(1,1,x_3,x_4)$
0	0	1	0	1	1
0	1	0	0	0	1
1	0	0	1	1	0
1	1	1	0	0	0

(A correct comparison with the values of the original function F is worth 5 points.)

The final step is to compare each function with the set of Boolean algebra operations, yielding:

$$F(x_1, \dots, x_4) = \underline{x_1} \cdot \underline{x_2} \cdot (\underline{x_3} \vee x_4) \cdot (x_3 \vee \underline{x_4}) \vee \underline{x_1} \cdot x_2 \cdot (\underline{x_3} \vee x_4) \vee x_1 \cdot \underline{x_2} \cdot \underline{x_4} \vee x_1 \cdot x_2 \cdot \underline{x_3}$$

(A correctly written disjunctive decomposition formula for  $x_1$  and  $x_2$  with pre-defined functions for  $x_3$  and  $x_4$  is worth 5 points.)

## Field of Science 2. Computer Science: Information Systems

**Task 7**  
**Entry level (1 point)**

Which of the following is a telecommunications device?

- a) Network adapter
- b) Processor
- c) Printer
- d) Video card

**Answer: a.**

**Task 8**  
**Entry level (1 point)**

List the disadvantages of Gantt chart data analysis.

- a) inflexibility, dependence, and overflow
- b) inflexibility, independence, and overflow
- c) flexibility, dependence, and overflow
- d) flexibility, independence, and overflow

**Answer: a.**

**Task 9**  
**Entry level (1 point)**

Which knowledge representation model aligns with the understanding of long-term memory organization in humans?

- a) Production representation
- b) Semantic networks
- c) Frames
- d) Integral representation

**Answer: b.**

**Task 10**  
**Intermediate level (3 points)**

Which are the main stages of working with data in information systems? Select all that apply.

- a) Extraction and transformation stage
- b) Machine learning stage
- c) Loading phase
- d) Data model development stage

**Answer: a, c.**

**Task 11**  
**Intermediate level (3 points)**

Which of the following are purposes of Data Storage (DS)? Select all that apply.

- a) Ensuring the collection, storage, and quick access to the key information
- b) Data visualization
- c) Operational analytical processing and data mining
- d) Viewing video files

**Answer: a, c.**

### Field of Science 3. Computer Science: Artificial Intelligence

#### Task 12

##### Entry level (1 point)

What happens when more variables are introduced into a linear regression model?

- a) Both might increase or decrease depending on the variables introduced.
- b) The R-squared value may increase or decrease, but the adjusted R-squared always increases.
- c) Both the R-squared and the adjusted R-squared always increase.
- d) The R-squared value may increase or remain constant; the adjusted R-squared may increase or decrease.

**Answer: d.**

#### Task 13

##### Entry level (1 point)

Which of the following represents the upper and lower bounds of the Matthews correlation coefficient (MCC) in binary classification?

- a) (0,1]
- b) [1,0)
- c) [-1,1]
- d) (-1,1)

**Answer: c.**

#### Task 14

##### Entry level (1 point)

What happens during neural network training?

- a) The number of layers and the number of neurons in each layer are tuned.
- b) The parameters of layers and weights are adjusted.
- c) The length of the gradient descent step is tuned.
- d) The input object is configured.

**Answer: b.**

#### Task 15

##### Intermediate level (3 points)

Which TWO of the following clustering algorithms suffer from the problem of convergence at local optima? Select all that apply.

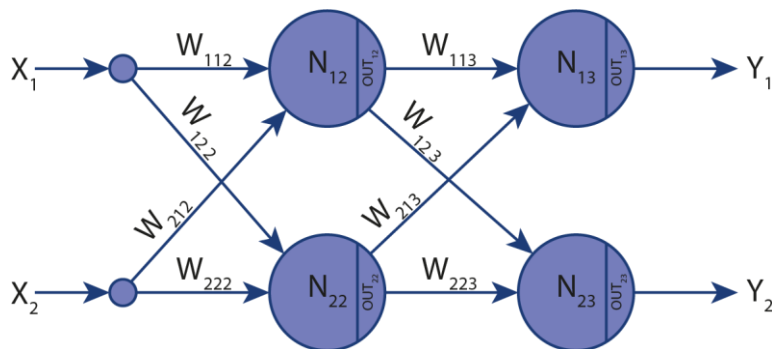
- a) K-Means++ algorithm
- b) EM algorithm
- c) Brute force algorithm
- d) K-Means algorithm

**Answer: b, d.**

#### Task 16

##### Advanced level (15 points)

Consider a two-layer perceptron with 2 neurons in the hidden layer and 2 neurons in the output layer. The input vector has a length of 2.



Each neuron is identified by the letter  $N_{jl}$ , where  $j$  describes the neuron number in the layer, and  $l$  is the layer number. Each neuron has an input, the weight of which is given by the value  $w_{ijl}$ , where  $i$  is the number of the neuron's input,  $j$  describes the neuron number in the layer, and  $l$  is the layer number. The neurons in the input layer do not perform any computational operations; they solely distribute the input signals.  $OUT_{jl}$  is the output value of the neuron.  $(X_1, X_2)$  is the input vector, i.e. the vector that is fed to the input of the network.  $(Y_1, Y_2)$  is the output vector that the neural network generates as a result of its operation. For the output layer  $OUT_{jl} = Y_j$ . The activation function of each neuron is a sigmoid.

The perceptron is trained using the backpropagation algorithm without a training schedule. The algorithm uses the concept of error gradient for each neuron— $\nabla E_{jl}$ . The mean squared error function is used as the error metric.

Weights of hidden layer neurons:

$W_{112}$	$W_{212}$	$W_{122}$	$W_{222}$
0.7599	0.1452	0.9608	0.6935

Weights of output layer neurons:

$W_{113}$	$W_{213}$	$W_{123}$	$W_{223}$
-0.2808	-0.1997	-0.9667	-0.6111

Input vector:

$X_1$	$X_2$
-0.5851	-0.5826

Expected output vector for a given input vector (training vector):

$D_1$	$D_2$
0.2030	-0.8542

Assignment:

1. Write the neuron activation formula.
2. Write the formula for calculating the outputs of neuron  $N_{12}$ .
3. Write the formula for calculating the error gradient for the output layer neuron  $N_{23}$ .
4. Write the formula for calculating the error gradient for the hidden layer neuron  $N_{22}$ .
5. Write the formula for calculating the correction of the weights of neuron  $N_{13}$ .
6. Calculate the output of each neuron  $OUT_{jl}$ .
7. Calculate all error gradients  $\nabla E_{jl}$ .

8. Calculate all new weights  $W_{ijl}$ .  
Round all calculation results to four decimal places ( $10^{-4}$ ).

**Note:** A complete solution must include your method and reasoning. Providing the final answer alone will not suffice.

**Solution:**

1. Neuron activation formula.

$$\text{sig}(x) = \frac{1}{1 + e^{-x}}$$

2. Formula for calculating the outputs of neuron  $N_{12}$ .

$$OUT_{12} = \text{sig}(x_1 * w_{112} + x_2 * w_{212})$$

3. Formula for calculating the error gradient for output layer neuron  $N_{23}$ .

$$\nabla E_{23} = Y_2 * (1 - Y_2) * (Y_2 - D_2)$$

4. Formula for calculating the error gradient for hidden layer neuron  $N_{22}$ .

$$\nabla E_{22} = OUT_{22} * (1 - OUT_{22}) * (\nabla E_{13} * w_{213} + \nabla E_{23} * w_{223})$$

5. Formula for calculating the correction of the weights of neuron  $N_{13}$ .

$$w_{113} = w_{113} - \nabla E_{13} * OUT_{12}$$

$$w_{213} = w_{213} - \nabla E_{13} * OUT_{22}$$

6. Outputs of each neuron  $OUT_{jl}$ .

$$OUT_{12} = \text{sig}(x_1 * w_{112} + x_2 * w_{212}) = \text{sig}(-0,44461749 - 0,08459352) = 0,3707$$

$$OUT_{22} = \text{sig}(x_1 * w_{122} + x_2 * w_{222}) = \text{sig}(-0,56216408 - 0,4040331) = 0,2756$$

$$OUT_{13} = \text{sig}(OUT_{12} * w_{113} + OUT_{22} * w_{213}) = \text{sig}(-0,10409256 - 0,05503732) = 0,4603$$

$$OUT_{23} = \text{sig}(OUT_{12} * w_{123} + OUT_{22} * w_{223}) = \text{sig}(-0,35835569 - 0,16841916) = 0,3713$$

7. Gradients  $\square E_{jl}$ .

$$\begin{aligned} \nabla E_{13} &= Y_1 * (1 - Y_1) * (Y_1 - D_1) = OUT_{13} * (1 - OUT_{13}) * (OUT_{13} - D_1) \\ &= 0,4603 * (1 - 0,4603) * (0,4603 - 0,2030) = 0,0639 \end{aligned}$$

$$\begin{aligned} \nabla E_{23} &= Y_2 * (1 - Y_2) * (Y_2 - D_2) = OUT_{23} * (1 - OUT_{23}) * (OUT_{23} - D_2) \\ &= 0,3713 * (1 - 0,3713) * (0,3713 - 0,8542) = 0,2861 \end{aligned}$$

$$\begin{aligned} \nabla E_{12} &= OUT_{12} * (1 - OUT_{12}) * (\nabla E_{13} * w_{113} + \nabla E_{23} * w_{123}) \\ &= 0,3707 * (1 - 0,3707) * (0,0639 * -0,2808 + 0,2861 * -0,9667) \\ &= -0,0687 \end{aligned}$$

$$\begin{aligned} \nabla E_{22} &= OUT_{22} * (1 - OUT_{22}) * (\nabla E_{13} * w_{213} + \nabla E_{23} * w_{223}) \\ &= 0,2756 * (1 - 0,2756) * (0,0639 * -0,1997 + 0,2861 * -0,6111) \\ &= -0,0375 \end{aligned}$$

8. New weights  $W_{ijl}$ .

$$w_{112} = w_{112} - \nabla E_{12} * x_1 = 0,7599 + 0,0687 * -0,5851 = 0,7197$$

$$w_{212} = w_{212} - \nabla E_{12} * x_2 = 0,1452 + 0,0687 * -0,5826 = 0,1052$$

$$w_{122} = w_{122} - \nabla E_{22} * x_1 = 0,9608 + 0,0375 * -0,5851 = 0,9389$$

$$w_{222} = w_{222} - \nabla E_{22} * x_2 = 0,6935 + 0,0375 * -0,5826 = 0,6717$$

$$w_{113} = w_{113} - \nabla E_{13} * OUT_{12} = -0,2808 - 0,0639 * 0,3707 = -0,3045$$

$$w_{213} = w_{213} - \nabla E_{13} * OUT_{22} = -0,1997 - 0,0639 * 0,2756 = -0,2173$$

$$w_{123} = w_{123} - \nabla E_{23} * OUT_{12} = -0,9667 - 0,2861 * 0,3707 = -1,0727$$

$$w_{223} = w_{223} - \nabla E_{23} * OUT_{22} = -0,6111 - 0,2861 * 0,2756 = -0,6899$$

**Answer:**

1.

$$\text{sig}(x) = \frac{1}{1 + e^{-x}}$$

2.

$$OUT_{12} = \text{sig}(x_1 * w_{112} + x_2 * w_{212})$$

3.

$$\nabla E_{23} = Y_2 * (1 - Y_2) * (Y_2 - D_2)$$

4.

$$\nabla E_{22} = OUT_{22} * (1 - OUT_{22}) * (\nabla E_{13} * w_{213} + \nabla E_{23} * w_{223})$$

5.

$$\begin{aligned} w_{113} &= w_{113} - \nabla E_{13} * OUT_{12} \\ w_{213} &= w_{213} - \nabla E_{13} * OUT_{22} \end{aligned}$$

6.

OUT <sub>12</sub>	OUT <sub>22</sub>	OUT <sub>13</sub>	OUT <sub>23</sub>
0.3707	0.2756	0.4603	0.3713

7.

$\nabla E_{12}$	$\nabla E_{22}$	$\nabla E_{13}$	$\nabla E_{23}$
-0.0687	-0.0375	0.0639	0.2861

8.

$W_{112}$	$W_{212}$	$W_{122}$	$W_{222}$	$W_{113}$	$W_{213}$	$W_{123}$	$W_{223}$
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0.7197	0.1052	0.9389	0.6717	-0.3045	-0.2173	-1.0727	-0.6899
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**Assessment criteria**

1. Three points are awarded for correctly recording the neuron activation formula, the formulas for calculating the output of neuron N12, the error gradient for hidden layer neuron N22, and the weight correction for neuron N13.
2. Calculating the output of each  $OUT_{jl}$  neuron and its error gradient is  $\nabla E_{jl}$  earns 6 points.
3. Calculating all new  $W_{ijl}$  weights is worth 6 points.

**Field of Science 4. Interdisciplinary Applications of Computer Science****Task 17****Entry level (1 point)**

There is a public key cryptosystem with the following parameters:  $e_A$  is the public key of subscriber A;  $e_B$  is the public key of subscriber B;  $d_A$  is the private key of subscriber A;  $d_B$  is the private key of subscriber B. Subscriber A wants to send a message to subscriber B. Which key does subscriber A use to encrypt the message?

- a)  $e_A$
- b)  $e_B$
- c)  $d_A$
- d)  $d_B$

**Answer: b.**

**Task 18****Entry level (1 point)**

Consider an additive Fibonacci generator with the operation equation  $X_n = (X_{n-1} + X_{n-2}) \bmod 17$ . At a certain point, the generator produced 9, followed by 11. What number will appear next in the output?

- a) 3
- b) 5
- c) 10
- d) 13

**Answer: a.**

**Task 19****Entry level (1 point)**

What is the multiplicative inverse of 3 mod 17?

- a) 1
- b) 3
- c) 6
- d) 13

**Answer: c.**

**Task 20**

**Intermediate level (4 points)**

An organization's security officer suspects that an insider is communicating with competitors through a steganographic channel. During an interview, one employee appeared visibly nervous. After intercepting the data flow from that employee's computer, the security officer determined that the employee was attempting to send a distress signal. What is the name of the insider's accomplice?

The intercepted fragment in hexadecimal form is:

F4 F1 F4 FC F4 F9 F4 F3 F4 F5 F2 FC F4 F8 F4 F5 F4 FC F5 F0

Table 1. ASCII Table Fragment

hex	char		hex	char
2C	,		4D	M
2E	.		4E	N
41	A		4F	O
42	B		50	P
43	C		51	Q
44	D		52	R
45	E		53	S
46	F		54	T
47	G		55	U
48	H		56	V
49	I		57	W
4A	J		58	X
4B	K		59	Y
4C	L		5A	Z

**Answer: ALICE**

**Task 21****Advanced level (15 points)**

The round function of the block cipher takes a 16-bit value as input. The round function includes the following operations:

- 1) Performing an XOR between the original value and the key;
- 2) Splitting the resulting value into nibbles and replacing each nibble according to Table 2.

Table 2. Round Function Substitution Table

Input	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Output	3	E	5	9	A	D	8	D	F	4	1	0	7	6	B	2

- 3) Performing a cyclic left shift of the obtained value by 3 positions.

What is the value of the lower (right) half of the encrypted message if the original message is 3D7B4AE3h and the upper (left) half of the encrypted message is 35FAh?

**Note:** A complete solution must include your method and reasoning. Providing the final answer alone will not suffice.

**Solution:**

We begin by decrypting the upper part of the encrypted message.

Let us convert 35FAh to binary form:

$$35FAh = 0011\ 0101\ 1111\ 1010$$

and perform a cyclic right shift by 3 positions. Thus, we obtain:

$$0100\ 0110\ 1011\ 1111 = 46BFh$$

(A correctly performed shift is worth 3 points.)

Then, we perform the inverse transformation using the table.

$$46BFh \rightarrow 9DE8h$$

(A correctly performed inverse substitution using the table is worth 3 points.)

Then we convert the obtained value and the value of the upper half of the original message into binary form:

$$9DE8h = 1001\ 1101\ 1110\ 1000,$$

$$37BDh = 0011\ 0111\ 1011\ 1101,$$

and calculate their sum modulo 2 to obtain the key value.

$$1001\ 1101\ 1110\ 1000$$

xor

$$0011\ 0111\ 1011\ 1101$$

=

$$1010\ 1010\ 0101\ 0101$$

(A correctly inverted XOR operation is worth 3 points.)

In total, correctly finding the key is worth  $3 + 3 + 4 = 9$  points.)

Now let us encrypt the lower half of the original text. First, we convert it into binary form:

$$4AE3h = 0100\ 1010\ 1110\ 0011$$

and add modulo 2 with the key

$$0100\ 1010\ 1110\ 0011$$

xor

$$1010\ 1010\ 0101\ 0101$$

=

$$1110\ 0000\ 1011\ 0110$$

(Correctly adding with the key is worth 2 points.)

Then we convert the obtained value into hexadecimal form:

$$1110\ 0000\ 1011\ 0110 = E0B6h$$

and perform the substitution using the table:

$$E0B6h \rightarrow B308h = 1011\ 0011\ 0000\ 1000$$

(A correct substitutions using the table is worth 2 points.)

The last step is cyclically shifting the value to the left by 3 positions and obtaining the result

$$1001\ 1000\ 0100\ 0101 = 9825h$$

(A correctly performed shift earns 2 points.)

In total, performing the round function with the known key is worth  $2 + 2 + 2 = 6$  points)

**Answer: 9825h**

## Field of Science 5: Computer Science: Software Engineering

### Task 22

#### Entry level (1 point)

In which lifecycle model are all software requirements clearly defined before development begins?

- a) Spiral
- b) Waterfall

- c) Incremental
- d) Iterative

**Answer: b.**

**Task 23**  
**Entry level (1 point)**

Which of the following is a methodology for flexible software development?

- a) V-Model
- b) Agile
- c) Waterfall
- d) All of the above

**Answer: b.**

**Task 24**  
**Entry level (1 point)**

Which language is classified as declarative?

- a) C, C++
- b) Assembler, Pascal
- c) PHP, Python
- d) HTML, SQL

**Answer: d.**

**Task 25**  
**Intermediate level (3 points)**

Which TWO stages does the software development life cycle include?

- a) Requirements analysis
- b) Testing
- c) Compilation
- d) Discussion

**Answer: a, b.**

**Task 26**  
**Intermediate level (3 points)**

Which TWO of the following actions does the user perform during the testing phase?

- a) syntax debugging
- b) test selection
- c) defining the test method
- d) defining the results output format

**Answer: b, c.**

**Field of Science 6. Computer Science: Hardware and Architecture**

**Task 27**  
**Entry level (1 point)**

Which technologies are used to increase the reliability and speed of a hard disk drive?

- a) increasing the capacity of the hard disk drive
- b) reducing the number of revolutions of the hard disk drive
- c) RAID
- d) longitudinal recording to disk

**Answer: c.**

**Task 28**  
**Entry level (1 point)**

Which of the following is true of low-level formatting?

- a) Low-level formatting refers to the process of dividing a disk into tracks and sectors.
- b) Low-level formatting is the process of organizing a disk into tracks and sectors, preparing it for data storage at the hardware level.
- c) Low-level formatting should be performed regularly.
- d) Low-level formatting depends on the file system type.

**Answer: a.**

**Task 29**  
**Entry level (1 point)**

Which of the following is true of processor commands?

- a) The command currently executed by the processor is located in the controller.
- b) The instruction currently being executed by the processor is located in the processor status register.
- c) Any command executed changes the value of the processor status register.
- d) A processor instruction has only one operand.

**Answer: c.**

**Task 30**  
**Intermediate level (3 points)**

Which of the following statements align with the principles of the von Neumann architecture? Select all that apply.

- a) A program is stored in memory as sequential code.
- b) The processor moves to the next instruction after completing the current one.
- c) The address of the next instruction is always the operand of the current instruction.
- d) There is RAM for storing instructions and separate RAM for storing data.
- e) Memory consists of numbered cells accessible by the processor.
- f) The binary number system is used to represent data.

**Answer: a, b, e.**

**Task 31**  
**Intermediate level (3 points)**

Which of the following tasks does the cache controller perform? Select all that apply.

- a) providing quick access to intensively used data
- b) preloading data into cache from RAM
- c) loading data into RAM from the hard drive
- d) lazy write from cache memory to RAM

- e) loading data into cache memory from a network resource
- f) monitoring the execution of instructions by the processor

**Answer: a, b, d.**

## **Field of Science 7. Telecommunications**

### **Task 32**

#### **Entry level (1 point)**

Which information does the switch collect about connected devices based on the packet information?

- a) The sender's IP address
- b) The recipient's IP address
- c) The sender's MAC address
- d) The recipient's MAC address

**Answer: c.**

### **Task 33**

#### **Entry level (1 point)**

Why is it necessary to specify the DNS server address?

- a) To determine the MAC address from the IP address
- b) To obtain the IP address of the resource
- c) To determine the DNS name from the IP address
- d) To obtain the DHCP server address

**Answer: b.**

### **Task 34**

#### **Entry level (1 point)**

What is the ping utility used for?

- a) To check whether the MAC address matches the IP address
- b) To check the download speed of files
- c) To test the presence of devices on the network
- d) To create data backups

**Answer: c.**

### **Task 35**

#### **Intermediate level (3 points)**

A router is a device that (select all that apply):

- a) Connects networks.
- b) Creates virtual networks.
- c) Connects devices in a network.
- d) Routes packets between networks.

**Answer: a, d.**