OLYMPIAD "I AM A MASTER'S DEGREE" FOR APPLICANTS TO A MASTER'S DEGREE

<u>04.09.02 INFORMATION SYSTEMS AND TECHNOLOGIES</u>

(ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN INFORMATION

SYSTEMS)

METHODOLOGICAL RECOMMENDATIONS FOR PREPARATION
TO THE QUALIFICATION STAGE OF THE OLYMPIAD
2025/2026 ACADEMIC YEAR

Authors: Professor of the Department of Computer Information Systems, Doctor of Physical and Mathematical Sciences Lyapin A. A.
Associate Professor of the Department of Computer Information Systems, PhD Shilyaeva O.V.
Associate Professor of the Department of CIS, Ph.D. in Physics and Mathematics. n. Anisimova G. B.

Chairman of the Methodological Commission:
Professor of the Department of "KIS", Doctor of Physical and Mathematical Sciences Lyapin A. A.

SELECTION STAGE

The qualifying round of the Olympiad "I am a Master" for applicants to the Master's program (hereinafter referred to as the Olympiad) in the field of study (program) 09.04.02 Information Systems and Technologies (Artificial Intelligence Technologies in Information Systems) is held remotely.

The questions are compiled automatically for each participant individually. Each Olympiad entry in the qualifying round includes questions that assess the Olympiad participants' level of preparedness within the Federal State Educational Standard.

Participants are allotted one (1) astronomical hour (60 minutes) to solve the problems in the Olympiad's qualifying round. The timer begins counting down from the moment the tasks are started. Participants determine the location and time for completing the tasks themselves. A computer with internet access is required to complete the tasks. The Organizing Committee is not responsible for any power or communication failures during the qualifying round.

Olympiad participants complete the qualifying round tasks only once. The qualifying round tasks consists of three sets of questions. For each correct answer in set 1, the participant receives 2 points; for each correct answer in set 2, 2 points; and for each correct answer in set 3, 2 points. The maximum possible score is 100.

The Olympiad tasks of the qualifying round include content elements from the following sections of the course: Modern programming technologies, Machine learning methods and algorithms, Information systems design tools [04/09/02 Information systems and technologies (Artificial intelligence technologies in information systems)]:

– Section 1. "Elements of programming";
– Section 2. "Elements of artificial intelligence";
– Section 3. "Elements of information systems design".

To design the variants of the Olympiad work for the selection stage, various methods of presenting information in the texts of the tasks were used.

The first block contains tasks that serve as an introductory test of knowledge of the basic syntax and fundamental constructs of the Python programming language. The questions cover fundamental topics necessary for programming.

The second section contains a comprehensive test on the fundamentals of artificial intelligence and machine learning. It covers both theoretical concepts and their practical implementation using Python libraries.

The third block tests knowledge of the fundamentals of systems analysis, design, and life cycle of software and information systems. The focus is on methodologies, processes, and standards.

An Olympiad participant receives an individual version of the Olympiad work from the qualifying round, consisting of 50 questions: 20 tasks from the first block of tasks, 20 tasks from the second block, and 10 tasks from the third block.

Each task is assessed based on the accuracy of the answer obtained. The points earned by the Olympiad participant for the tasks completed are added together.

LIST OF CONTENT ELEMENTS INCLUDED IN THE OLYMPIAD TASKS OF THE SELECTION STAGE OF THE 2025/2026 ACADEMIC YEAR

Section 1. "Elements of Programming"

<u>Section Description</u>
This section is an introductory test of the basic syntax and fundamental constructs of the Python programming language. The questions cover the fundamental topics necessary for getting started with programming.

<u>Key topics tested in the block</u>
– Basic data output.
– Working with variables and data entry.
– Arithmetic operations and their priority.
– Logical operations and expressions.
– Conditional operators.
– Cycles, including flow control.
– Working with strings (indexing, slicing, methods).
– Working with lists and other data structures.
– Basics of functions.

<u>Nature of tasks</u>
The tasks are formulated as typical multiple-choice questions, requiring you to predict the outcome of code execution, select the correct syntax, or determine the behavior of a language construct.

<u>Example of questions (tasks)</u>

1. What will this code output (for Python programming language)?

```python
total = 0
for num in [1, 2, 3, 4]:
    total += num
print(total)
```

- o 1
- o 4
- o 10
- o 24

<u>Answer: 10</u>

2. How many numbers will this code print (for Python programming language)?

```python
for i in range(10, 0, -2):
    print(i)
```

- ○ 4
- ○ 5
- ○ 10
- ○ 0

Answer: 5

3. What will this code output (for Python programming language)?

```python
matrix = [[1, 2], [3, 4]]
for row in matrix:
    print(row[0],end=" ")
```

- ○ 1 2 3 4
- ○ 1 3
- ○ 1 2
- ○ 2 4

Answer: 1 3

Section 2. "Elements of Artificial Intelligence"

Section Description
This section is a comprehensive test on the fundamentals of artificial intelligence and machine learning. It covers both theoretical concepts and their practical implementation using Python libraries.

Key topics tested in the block
- – Fundamentals of Artificial Intelligence.
- – Machine learning.
- – Data preprocessing.
- – Specialized areas of machine learning.

Nature of tasks
The tasks require both a theoretical understanding of AI concepts and practical knowledge of the algorithms and libraries used to solve specific problems. Many questions require selecting one or more correct answers, which tests the ability to distinguish between similar concepts.

Example of questions (tasks)

1. **Which of the following is an example of deductive reasoning?**
   o "Nina is a teacher and a diligent person; therefore, all teachers are diligent."
   o All birds can fly; penguins are birds; therefore, penguins can fly.
   o "All women over 60 are grandmothers; Elena is 65 years old; therefore, she is a grandmother."
   o "The sun rises daily; tomorrow it will rise again."
   Answer: "All women over 60 are grandmothers; Elena is 65 years old; therefore, she is a grandmother."

2. **What is the formula for accuracy in classification?**
   o $(TP + FN) / (TP + TN + FP + FN)$
   o $(TP + TN) / (TP + TN + FP + FN)$
   o $TP / (TP + FP)$
   o $TP / (TP + FN)$
   Answer:$(TP + TN) / (TP + TN + FP + FN)$

3. **What steps does K-Means clustering involve? (Select all that apply)**
   o Specifying the number of clusters (K)
   o Random initialization of cluster centroids
   o Assigning data points to the nearest centroid
   o Using backpropagation to update weights
   Answer:
   Specifying the number of clusters (K)
   Random initialization of cluster centroids
   Assigning data points to the nearest centroid

Section 3. "Elements of information systems design"

Section Description
This module tests knowledge of the fundamentals of systems analysis, design, and life cycle of software and information systems. It focuses on methodologies, processes, and standards.

Key topics tested in the block
1. Fundamentals of Software Engineering.
2. Software/IS Life Cycle.
3. Standards.
4. Requirement's development processes.
5. Testing.
6. Canonical IC design.
7. Operation and maintenance of information systems.
8. Ensuring the reliability of data in the database.
9. Data models.

Nature of tasks

The questions are designed to test students' understanding of software development processes, methodologies, and standards. They require a clear definition of concepts, knowledge of terminology, and an understanding of the sequence and interrelationships of stages in the information systems lifecycle.

Example of questions (tasks)

1. What type of testing tests a single module, in isolation from the rest of the system?
- when performing integration testing
- when performing unit testing
- when performing system testing

Answer: when performing unit testing

2. What refunds are not possible in waterfall development?
- return from coding to testing
- return from testing to analysis
- return from testing to coding

Answer: return from testing to analysis

3. True statements:
- ISO/IEC 12207 does NOT regulate the life cycle of information systems.
- ISO/IEC 12207 standard regulates canonical design
- ISO/IEC 12207 standard regulates the life cycle of information systems
- The ISO/IEC 12207 standard regulates the operation of DBMS

Answer: ISO/IEC 12207 standard regulates the life cycle of information systems

Literature for preparation

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