APPROVED by
Academic supervisor of Master
of computer vision program
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National Research University Higher School of Economics

Faculty of Informatics, Mathematics, and Computer Science

ENTRANCE EXAMINATION REGULATIONS FOR MASTER'S PROGRAMME "MASTER OF COMPUTER VISION", DEVELOPED ON THE BASIS OF HSE UNIVERSITY'S EDUCATIONAL STANDARDS IN THE FIELD OF STUDY 01.04.02 APPLIED MATHEMATICS AND INFORMATICS

Academic supervisor Andrey Savchenko _____

1. EXAM CRITERIA

- Exam consists of four (4) problems, the correct solution of each gives 25 points to the grade.
- Each prospective student should get at least 31 points to pass entrance exam successfully.
- The duration of the exam is **120 minutes**.
- The exam is held online with a camera controlling system "ProctorEdu".
- During the exam, blank sheets and a pen/pencil, calculator and all kind of paper directories are allowed, the use of electronic devices is prohibited.

2. TOPICS COVERED AT AN ENTRANCE EXAM

1. **Linear algebra**
Vectors, matrices, determinants, linear operators, eigenvalues and eigenvectors, and quadratic forms.
2. **Mathematical analysis**
Limits, derivatives, integrals, functions of one and many variables.
3. **Combinatorics and theory of probabilities**
Permutations and combinations, the inclusion-exclusion principle, discrete and continuous random variables, mathematical expectation and variance, distribution function, conditional probability, joint distribution.
4. **Discrete Mathematics**
Boolean algebra, graphs, Euler and Hamiltonian cycle, set theory, binary relations.
5. **Algorithms and data structures**
Computational complexity, merge sort, count sort, stack, queue, list, vector, binary tree, hash table, recursive algorithms, iterative algorithms, backtracking search.
6. **Programming in C++**
The main constructs of the C++ programming language: branches, loops, functions, arrays, pointer arithmetic, recursion, structures, classes, unions, the C standard library, the STL library.
7. **Programming in Python**
The main constructs of the Python programming language: branches, loops, functions, data collections, classes.

3. REFERENCES

Mathematics

1. Cormen, Leiserson, Rivest, Stein. Introduction to Algorithms.

2. Silvanus P. Thompson. Calculus Made Easy.

Programming
1. Luciano Ramalho, Fluent Python – Published by O'Reilly Media, Inc., 2015.
2. Bjarne Stroustrup, The C++ Programming Language, 4th edition, Addison-

Wesley,2013

3. Beginning C++20: From Novice to Professional, Authors: Ivor Horton, Peter Van Weert , Published: October 4, 2020, Publisher: Apress; 6th ed. edition

4. Beginning C++17: From Novice to Professional, Authors: Ivor Horton, Peter Van Weert , Published: March 24, 2018, Publisher: Apress; 5th ed. edition

5. C++ Crash Course: A Fast-Paced Introduction, Authors: Josh Lospinoso, Published: September 24, 2019, Publisher: No Starch Press; Illustrated edition

6. A Tour of C++ (C++ In-Depth), Authors: Stroustrup Bjarne , Published: July 20, 2018, Publisher: Addison-Wesley Professional; 2nd edition

7. A Tour of C++ (C++ In-Depth), Authors: Stroustrup Bjarne , Published: July 20, 2018, Publisher: Addison-Wesley Professional; 2nd edition

8. Learning Python: Powerful Object-Oriented Programming 5th Edition, Kindle Edition, Authors: Mark Lutz, Published: June 12, 2013, Publisher: O'Reilly Media; 5th edition

9. Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming, Authors: Eric Matthes, Published: May 21, 2019, Publisher: No Starch Press; 2nd edition