

## Undergraduate Track Program: Computer and Data Science

### 1. Olympiad winner's Skill Set

To win the Olympiad, you must demonstrate proficiency in programming, an understanding of algorithm analysis and design, and a strong grasp of the mathematical foundations of algorithms, including:

- one of the programming languages, such as Python; concepts of procedural and object-oriented programming; methods of describing algorithms;
  - mathematical foundations of computer science: number systems, converting numbers from one number system to another, Boolean algebra, standard Boolean operations;
  - basic concepts of mathematics: matrix and its rank, determinant, inverse matrix; the concept of a directed and undirected graph, paths in a graph, the concept of a function and its derivative;
- You should also have a solid command of the following skills:
- developing algorithms related to data processing and implement them in software in one of the programming languages;
  - solving problems based on the listed mathematical foundations using one of the programming languages.

### 2. List of Eligible Degree Programs

#### 2.1 Bachelor's Degree Programs

01.03.02 Applied Mathematics and Computer Science

01.03.04 Applied Mathematics

02.03.01 Mathematics and Computer Sciences

02.03.02 Fundamental Computer Science and Information Technologies

02.03.03 Mathematical Support and Administration of Information Systems

09.03.01 Informatics and Computer Technology

09.03.02 Information Systems and Technologies

09.03.03 Applied Informatics

09.03.04 Software Engineering

### 3. Program Content

#### Applied Mathematics

1. Vectors and vector operations.
2. Matrices and matrix operations.
3. Matrix rank.
4. Matrix determinant. Reverse matrix.
5. Modular arithmetic.
6. Definition of probability. Elementary properties: theorem of addition of probabilities, theorem of multiplication of probabilities.
7. Basic combinatorial numbers: numbers of placements (permutations), combinations.
8. Graphs: undirected, oriented, bipartite, complete.
9. Distances in graphs.
10. Breadth-first and depth-first graph traversal.

#### Computer Science and Information Systems

1. Concept of information.
2. General characteristics of collecting, transmitting, processing, and storing information.

## PROGRAM

3. Units of information measurement.
4. Data structures.
5. Concept of information system and information technology.
6. Programming languages.
7. Concepts of procedure-oriented and object-oriented programming.
8. Methods for algorithm description.
9. Unified system of software documentation.
10. Software life cycle.

### **Computer Science and Artificial Intelligence**

1. Introduction to machine learning. Role of AI in human life: ethics and regulation.
2. Introduction to Python programming.
3. Organization of data input and output.
4. Programming of linear algorithms.
5. Programming of branching algorithms. Conditional operator.
6. Repetitive algorithm construction. Programming cycles with a given condition for continuing operation.
7. Programming cycles with a specified number of repetitions.
8. Data Science. Data structures.
9. Working with Python lists.
10. Python libraries. Pandas. Data structures in Pandas.
11. DataFrame structure. Basic operations with data sets.
12. Descriptive statistics
13. Data visualization
14. Concept and types of machine learning. Machine training libraries.
15. Linear regression
16. Nonlinear dependencies
17. Classification. Logistics regression.
18. Decision trees

### **Interdisciplinary Applications of Computer Science**

1. General purpose applications.
2. Text and graphic editors
3. Calculators and electronic tables.
4. Sound and video editors, multimedia players.
5. Communication programs and messengers.
6. Applied software development tools.
7. Programming languages, integrated development environments.
8. Programming technologies, introduction to OOP.
9. Software security.
10. Principles of structural and functional organization of computer networks.
11. Reliability of the hardware and software complex of an information system.
12. Models and systems for controlling access to information resources.
13. Identification, authentication, and authorization.
14. Methods of authentication and authorization.

### **Computer Science and Software Engineering**

1. Applied software development tools.

## PROGRAM

2. Programming languages, integrated development environments.
3. Programming technologies, introduction to OOP.
4. Interface and basic tools for various platforms.
5. Programming object behavior, using various programming languages.
6. Using standard containers to store and process multiple objects.
7. Programming objects interaction.
8. Software requirements.
9. Software testing.
10. Software support.
11. Software development control.
12. Software quality control.

### **Computer Science, Hardware, and Architecture**

1. Concepts of computer hardware, hardware architecture.
2. History of the development of computing devices and instruments. Classification of computers.
3. Basic logical operations and circuits: conjunction, disjunction, negation. Truth tables.
4. Circuit logic elements: registers, triggers, adders, multiplexer, demultiplexer, encoder, decoder, comparator.
5. Operating principles of basic logical elements, truth table, logical expressions, scheme.
6. Basic concepts of computer architecture. Von Neumann principles (architecture).
7. Classification of computing system architectures: classical architecture, Flynn classification.
8. Organization of work, functioning of the processor. Microprocessors: CISC, RISC, MISC.
9. Processor instruction systems. Processor registers: essence, purpose, types.
10. Parallelism of calculations. Pipelining of calculations. Superscalarization. Matrix and vector processors.
11. System boards. Types, characteristics, form factors.
12. Interface types: serial, parallel, radial.
13. PC cases. Types, characteristics, form factors
14. Power supplies. Types, characteristics, form factors
15. Direct memory access. Interrupts. Drivers. PandP specification.
16. Types of memory in technical means of informatization: permanent, variable, internal, external.
17. Monitors and video adapters. Device, principle of operation, connection.
18. Computer peripheral devices and interfaces for their connection.

### **Telecommunications**

1. Introduction to computer networks and telecommunications.
2. Basic definitions and classification of computer networks. Client/server architecture.
3. Main types of data processing systems: computing complexes, systems, and networks.
4. Principles of multi-level organization of global and local computer networks.
5. Communication lines and presentation of information. Characteristics of communication lines. Analog and digital communication lines.
6. Transfer and access methods. Analog modulation. Digital coding and requirements for digital coding methods.
7. Ethernet technology. Ethernet Standards and Development.
8. Network structuring devices. Physical structuring: repeaters and hubs.

## PROGRAM

9. Logical structuring of the network: bridges and switches. Routers.
10. Addressing in IP networks. Types of addresses: physical, network, and symbolic.
11. Network operating systems.
12. Organization of corporate networks.
13. Network security. Problems of secrecy in networks and the use of cryptography methods.
14. Virtual Private Networks. Trends in the development of telecommunications systems.

## 4. Recommended References

### 4.1. Reading List

#### Applied Mathematics

Sources in English	Topic
1. Meyer A.R. Mathematics for Computer Science – Massachusetts Institute of Technology, 2010. – 519 p. URL: <a href="https://archive.org/details/ost-computer-science-mcs/">https://archive.org/details/ost-computer-science-mcs/</a>	1–4
2. Sparks J.C. The Handbook of Essential Mathematics – Air Force Publication, 2006. – 205 p. URL: <a href="http://wpafbstem.com/pages_main/math_resources/math_handbook1.pdf">http://wpafbstem.com/pages_main/math_resources/math_handbook1.pdf</a>	5–6
3. Stavely A.M. A Gentle Introduction to Discrete Math Featuring Python – Published by The New Mexico Tech Press, a New Mexico nonprofit corporation, 2014. – 260 p. URL: <a href="https://webpages.math.luc.edu/~lauve/courses/215-fa2016/Stavely_python_ebook.pdf">https://webpages.math.luc.edu/~lauve/courses/215-fa2016/Stavely_python_ebook.pdf</a>	7–10

Source name in Russian	Related topic
1. Beklemishev D.V. Course of analytical geometry and linear algebra –M.: Nauka. Ch. ed. fiz.–mat., lit., 1987. – 320 p. URL : <a href="https://dspace.enu.kz/handle/data/8092">https://dspace.enu.kz/handle/data/8092</a>	14
2. Haggarty R. Discrete mathematics for programmers – Moscow: Publishing house TECHNOSPHERE, 2012. –317 p. URL : <a href="https://monster-book.com/diskretnaya-matematika-dlya-programmistov">https://monster-book.com/diskretnaya-matematika-dlya-programmistov</a>	7–10
3. Gasko R. Simple mathematics for simple programmers. –M.: SOLONPress, 2018. –260 p. URL: <a href="https://coollib.in/b/612640-rik-gasko-prostaya-matematika-dlya-prostyih-programmistov/">https://coollib.in/b/612640-rik-gasko-prostaya-matematika-dlya-prostyih-programmistov/</a>	5–6

#### Computer Science and Information Systems

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1. Alvarado C., Dodds Z., Kuenning G., Libeskind-Hadas R. CS for All: An Introduction to Computer Science Using Python. – Franklin, Beedle and Associates Inc., 2019. – 288 p. URL: <a href="https://www.cs.hmc.edu/twiki/bin/view/CSforAll/">https://www.cs.hmc.edu/twiki/bin/view/CSforAll/</a>	1–5
2. Python® Notes for Professionals: Free Programming Books. URL: <a href="https://goalkicker.com/PythonBook/">https://goalkicker.com/PythonBook/</a>	8–10

3. Wienand I. Computer Science from the Bottom Up. BottomUp – CS.com, 2022. – 205 p. URL: <a href="https://www.bottomupcs.com/">https://www.bottomupcs.com/</a>	6–7
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1. Buzmakova M. M. Computer science and fundamentals of programming. – Perm: Perm state national research univ., 2017. – 180 p. URL : <a href="http://www.psu.ru/files/docs/personalnye-stranitsy-prepod-avatelej/buzmakova/buzmakova.pdf">http://www.psu.ru/files/docs/personalnye-stranitsy-prepod-avatelej/buzmakova/buzmakova.pdf</a>	1–5, 8–10
2. Galchenko G. A., Drozdova O. N. Informatics for colleges. Textbook –Phoenix, 2017. – 380 p. URL : <a href="https://delphinus..xyz/books/informatika-dlya-kolledjey-uch?ysclid=lyomsvenzx314317252">https://delphinus..xyz/books/informatika-dlya-kolledjey-uch?ysclid=lyomsvenzx314317252</a>	1–4
3. Louridas P. Algorithms for beginners. Theory and practice for the developer. Moscow: Eksmo, 2018. – 608 p. URL : <a href="https://monster-book.com/algoritmy-dlya-nachinayushchih">https://monster-book.com/algoritmy-dlya-nachinayushchih</a>	6–7

### Computer Science and Artificial Intelligence

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1. Klimczak P. Limits and Prospects of Artificial Intelligence. – Transcript Publishing, 2023. – 290 p. URL: <a href="https://www.degruyter.com/document/doi/10.1515/9783839457320/pdf?licenseType=open-access">https://www.degruyter.com/document/doi/10.1515/9783839457320/pdf?licenseType=open-access</a>	1, 10–18
2. Raschka S. Python machine learning. – Packt Publishing, 2017. – 595 p. URL: <a href="http://radio.eng.niigata-u.ac.jp/wp/wp-content/uploads/2020/06/python-machine-learning-2nd.pdf">http://radio.eng.niigata-u.ac.jp/wp/wp-content/uploads/2020/06/python-machine-learning-2nd.pdf</a>	10–18
3. Wang H. Introduction to Computer Programming with Python: – Athabasca University Press, 2023. – 504 p. URL: <a href="https://www.aupress.ca/books/oer-202301-introduction-to-computer-programming-with-python/">https://www.aupress.ca/books/oer-202301-introduction-to-computer-programming-with-python/</a>	2–9

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1. Borovskaya E.V., Davydova N.A. Fundamentals of artificial intelligence: textbook / 4th ed., electronic.. – M.: Laboratory of Knowledge, 2020. – 130 p. URL : <a href="https://lib.tau-edu.kz/wp-content/uploads/2023/01/Borovskaya-E.V.-Fundamentals-of-artificial-intelligence.pdf">https://lib.tau-edu.kz/wp-content/uploads/2023/01/Borovskaya-E.V.-Fundamentals-of-artificial-intelligence.pdf</a>	1, 10–18
2. Kotenkov I., Baushenko M., Ovsyannikova A., Chernov I., Kosarevsky D. Python from ods.. ai URL : <a href="https://open-data-science.github.io/pycourse/base/">https://open-data-science.github.io/pycourse/base/</a>	2–9
3. Vatyana A.S., Gusarova N.F., Dobrenko N.V. Artificial intelligence systems. – St. Petersburg: ITMO University, 2022. – 186 p. URL : <a href="https://books.ifmo.ru/file/pdf/3142.pdf">https://books.ifmo.ru/file/pdf/3142.pdf</a>	10–18

### Interdisciplinary Applications of Computer Science

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2. Murray K. Microsoft Office 365: Connect and Collaborate Virtually Anywhere, Anytime –Microsoft Press; 1 edition, 2012. – 337 p. – URL: <a href="https://download.microsoft.com/download/1/2/F/12F1FF78-73E1-4714-9A08-6A76FA3DA769/656949ebook.pdf">https://download.microsoft.com/download/1/2/F/12F1FF78-73E1-4714-9A08-6A76FA3DA769/656949ebook.pdf</a>	1–5
3. National Institute of Standards and Technology. An Introduction to Computer Security: The NIST Handbook – NIST, 2022. – 290 p. URL: <a href="https://csrc.nist.gov/publications/nistpubs/800-12/800-12-html/">https://csrc.nist.gov/publications/nistpubs/800-12/800-12-html/</a>	9–14

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3. Vostretsova E.V. Fundamentals of information security –Ekaterinburg: Ural Publishing House. University, 2019.— 204 p. URL : <a href="https://elar..urfu..ru/bitstream/10995/73899/3/978-5-7996-2677-8_2019.pdf">https://elar..urfu..ru/bitstream/10995/73899/3/978-5-7996-2677-8_2019.pdf</a>	9–14

### Computer science and Software Engineering

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2. Marrer G. Fundamentals of Programming With Object-Oriented Programming. – Gary Marrer, 2009. – 359 p. URL: <a href="https://ia600706.us.archive.org/13/items/bub_gb_TZ-qjncsv6QC/bub_gb_TZ-qjncsv6QC.pdf">https://ia600706.us.archive.org/13/items/bub_gb_TZ-qjncsv6QC/bub_gb_TZ-qjncsv6QC.pdf</a>	1–7
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2. Orlov S.A. Software engineering. – St. Petersburg: Peter, 2016. – 640 p. URL : <a href="https://www.kaznu.kz/content/files/news/folder23173/Orlov_Programmnaya_">https://www.kaznu.kz/content/files/news/folder23173/Orlov_Programmnaya_</a>	8–12

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3. Zadorozhny S.S., Fadeev E.P. Object-oriented programming in Python –M.: Moscow State University. M. V. Lomonosova, 2022. – 140 p. URL : <a href="https://cmp.phys.msu.ru/sites/default/files/OOP_on_Python_Tutorial%20guide_var7.pdf?ysclid=lypdcsuan5118744737">https://cmp.phys.msu.ru/sites/default/files/OOP_on_Python_Tutorial%20guide_var7.pdf?ysclid=lypdcsuan5118744737</a>	1–7

### Computer Science, Hardware, and Architecture

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1. Englander I. The Architecture of Computer Hardware and System Software. – John Wiley and Sons, 2009. – 708 p. URL: <a href="https://aitskadapa.ac.in/e-books/CSE/SOFTWARE%20ENGINEERING/The%20Architecture%20of%20Computer%20Hardware%20and%20System%20Software%20(%20PDFDrive%20).pdf">https://aitskadapa.ac.in/e-books/CSE/SOFTWARE%20ENGINEERING/The%20Architecture%20of%20Computer%20Hardware%20and%20System%20Software%20(%20PDFDrive%20).pdf</a>	1–6
2. Ledin J. Modern Computer Architecture and Organization. – Packt Publishing, 2020. – 561 p. URL: <a href="https://viterbi-web.usc.edu/~yudewei/main/sources/books/Modern%20Computer%20Architecture%20and%20Organization%20Learn%20processor%20architecture%20including%20RISC-V,%20and%20design%20of%20PCs,%20cloud%20servers,...%20(Jim%20Ledin)%20(z-lib.org).pdf">https://viterbi-web.usc.edu/~yudewei/main/sources/books/Modern%20Computer%20Architecture%20and%20Organization%20Learn%20processor%20architecture%20including%20RISC-V,%20and%20design%20of%20PCs,%20cloud%20servers,...%20(Jim%20Ledin)%20(z-lib.org).pdf</a>	12–18
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2. Maksimov N.V., Partyka T.L., Popov I.I. Architecture of computer and computer systems. – M.:FORUM-INFRA-M, 2005. – 512 p. URL : <a href="https://studizba.com/files/show/pdf/63836-1-maksimov-n-v-partyka-t-l-popov-i-i.html">https://studizba.com/files/show/pdf/63836-1-maksimov-n-v-partyka-t-l-popov-i-i.html</a>	17–18
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### Telecommunications

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#### 4.2. Recommended online courses Applied Mathematics

Online courses in English	Link	Summary
1. Math for Programmers	<a href="https://www.scaler.com/topics/course/maths-for-programmers/">https://www.scaler.com/topics/course/maths-for-programmers/</a>	This course covers basic mathematical concepts used in programming, including algebra, calculus, probability, and statistics.
2. Linear Algebra	<a href="https://allthemath.org/course/linear-algebra/">https://allthemath.org/course/linear-algebra/</a>	This course introduces participants to linear algebra. It is structured into key blocks: introduction to algebra, vectors, linear independence, matrices, linear transformations, matrix multiplication, and practical applications of these concepts.
3. Calculus	<a href="https://www.khanacademy.org/math/calculus-1">https://www.khanacademy.org/math/calculus-1</a>	The course consists of the following blocks: limits and continuity, derivatives: definition and basic rules, applications of derivatives, analysis of functions, integrals, applications of integrals.

Online courses in English	Link	Summary
1. Basic mathematics for digital professions	<a href="https://practicum.yandex.ru/math-foundations/">https://practicum.yandex.ru/math-foundations/</a>	This course provides a comprehensive introduction to key concepts in discrete mathematics, covering topics such as sets and logic, numerical sets, and elements of logic. It delves into combinatorics, exploring factorials, permutations, placements, and binomial coefficients. The course also introduces fundamental principles of probability theory and examines the behavior of



		random variables.
2. Linear algebra	<a href="https://edu.sirius.online/course/linearalgebra?xid=B953ZB">https://edu.sirius.online/course/linearalgebra?xid=B953ZB</a>	This course focuses on linear algebra, which has applications in computer science, physics, and economics. It pays special attention to the Gaussian method—the algorithm to solve systems of linear equations. The course also provides skills in working with vectors on the plane, in three-dimensional space, and in a space of arbitrary dimension.
3. Mathematical analysis	<a href="https://edu.sirius.online/#/course/1922">https://edu.sirius.online/#/course/1922</a>	This course focuses on mathematical analysis—the largest area of mathematics in terms of applications, which include calculating complex financial scenarios, developing diagnostic algorithms for various diseases, cryptographic algorithms, and information security systems. The course also provides an understanding of what a continuous line, a smooth line and an area are.

### Computer Science and Information Systems

Online courses in English	Link	Summary
1. Computer Science Fundamentals	<a href="https://code.org/curriculum/csf">https://code.org/curriculum/csf</a>	This course introduces students to fundamental computer science concepts, while exploring to explore how computers and technology impact the world.
2. Introduction to Computer Science	<a href="https://pll.harvard.edu/course/cs50-introduction-computer-science">https://pll.harvard.edu/course/cs50-introduction-computer-science</a>	This entry-level course teaches algorithmic thinking and effective problem-solving. Topics include abstraction, algorithms, data structures, encapsulation, resource management, security, software development, and web development. Programming languages covered include C, Python, SQL, and JavaScript, as well as CSS and HTML. The course utilizes problem sets from applied areas, such as biology, cryptography, finance, and forensics.
3. Introduction to Computer Science and Programming	<a href="https://www.coursera.org/specializations/introduction-computer-science-programming">https://www.coursera.org/specializations/introduction-computer-science-programming</a>	The course covers topics ranging from the basic principles of computing to the mathematical foundations of computer science. It explores the fundamental concepts of computer operation that can be applied to any software or computer system, equipping participants with the practical skills in writing interactive graphics programs at the entry level. The course's Numerical Mathematics component provides computational tools for problem-solving and modeling.

Online courses in English	Link	Summary
1. Basics of	<a href="https://intuit.ru/studies">https://intuit.ru/studies</a>	The first part of the course introduces programming

computer science and programming	/courses/105/105/info	languages, while the second one outlines practical methods for constructing correct small programs. In the third part, participants are introduced to object-oriented programming, the basics of implementing basic data structures, and consideration of small software projects—prototypes of real-life problems.
2. Algorithms: theory and practice	<a href="https://stepik.org/course/217/">https://stepik.org/course/217/</a>	The course covers basic algorithmic methods: greedy algorithms, divide and conquer, and dynamic programming. In addition to the theoretical foundations, it discusses the intricacies of implementing algorithms in C++, Java, and Python.
3. Mathematics and computer science for programmers	<a href="https://gb.ru/courses/3925">https://gb.ru/courses/3925</a>	This course familiarizes students with the basic concepts of higher mathematics, computer science, and mathematical logic.

### Computer Science and Artificial Intelligence

Online courses in English	Link	Summary
1. AI For Everyone Course	<a href="https://www.coursera.org/learn/ai-for-everyone">https://www.coursera.org/learn/ai-for-everyone</a>	This course focuses on the common AI terminology, including neural networks, machine learning, deep learning and data science. It outlines the scope of AI capabilities, while casting light on machine learning and running science projects about data. The course explores how to effectively collaborate with an AI team and develop an AI strategy within a company. It also addresses how to navigate ethical and public discussions surrounding AI. While the course is primarily non-technical, it also provides valuable insights for programmers interested in understanding the business aspects of AI.
2. AI Overview	<a href="https://connect.huawei.com/intl/en-us/courses/learn/course-v1:HuaweiX+CBUENXE005+Self-paced/about/sp:cloudEdu_en">https://connect.huawei.com/intl/en-us/courses/learn/course-v1:HuaweiX+CBUENXE005+Self-paced/about/sp:cloudEdu_en</a>	This course provides an overview of artificial intelligence (AI), technical aspects and applications of AI, strategy for AI development, open issues in AI, while also outlining the future prospects of the technology.
3. Introduction to Artificial Intelligence with Python	<a href="https://pll.harvard.edu/course/cs50s-introduction-artificial-intelligence-python">https://pll.harvard.edu/course/cs50s-introduction-artificial-intelligence-python</a>	The course explores the concepts and algorithms behind modern artificial intelligence and examines the ideas behind technologies such as game engines, handwriting recognition, and machine translation. Through hands-on projects, students learn the theory behind graph search algorithms, classification,

		optimization, reinforcement learning, and other topics in artificial intelligence and machine learning.
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<b>Online courses in English</b>	<b>Link</b>	<b>Summary</b>
1. Introduction to Machine Learning	<a href="https://edu.sirius.online/course/mlintro?xid=AO9ZEN">https://edu.sirius.online/course/mlintro?xid=AO9ZEN</a>	This course explores how to determine if a problem is suitable for machine learning, outlines the stages of solving such a problem, and guides students through implementing each stage independently to achieve a solution. It provides a comprehensive understanding of the machine learning process, from problem identification to practical implementation.
2. Introduction to AI	<a href="https://ai-academy.ru/training/courses/vvodnyy-kurs-vvedenie-v-ii/">https://ai-academy.ru/training/courses/vvodnyy-kurs-vvedenie-v-ii/</a>	The course explores the applications of artificial intelligence, deepens the understanding of machine learning (or introduces it for newcomers), and highlights the roles of professionals in this field.
3. Application development in Python	<a href="https://www.youtube.com/playlist?list=PL6plRXMq5RACy7NhEK4tdLeKxmKmxDIrr">https://www.youtube.com/playlist?list=PL6plRXMq5RACy7NhEK4tdLeKxmKmxDIrr</a>	This series of courses covers programs in the Python programming language, which in turn involves a wide range of technologies, such as PyQt5, SQLite3, and Selenium.

### Computer Science and Artificial Intelligence

<b>Online courses in English</b>	<b>Link</b>	<b>Summary</b>
1. Introduction to Computer Science and Programming	<a href="https://www.coursera.org/specializations/introduction-computer-science-programming">https://www.coursera.org/specializations/introduction-computer-science-programming</a>	The course covers topics ranging from the basic principles of computing to the mathematical foundations required for computer science. Students learn fundamental concepts of computer operation applicable to any software or computer system. They also acquire practical skills necessary for writing entry-level interactive graphics programs. The Numerical Mathematics component provides computational tools essential for problem-solving and modeling throughout various stages of computer science studies.
2. Computer Science Fundamentals	<a href="https://code.org/curriculum/csf">https://code.org/curriculum/csf</a>	This course introduces students to fundamental computer science concepts, exploring how computers and technology impact the world.
3. Network security and database vulnerabilities	<a href="https://www.coursera.org/learn/network-security-database-vulnerabilities?irclickid=ySGUMowi5xyKUIW3AATB6SLIUkC2">https://www.coursera.org/learn/network-security-database-vulnerabilities?irclickid=ySGUMowi5xyKUIW3AATB6SLIUkC2</a>	This course provides the foundation needed to understand the fundamentals of network security. It covers local area networks, TCP/IP, the OSI structure, and routing basics, explaining how network technologies affect security systems within an organization. The course also examines the network

	2aVcNwSq0g0andirgwc=1andutm_medium=partnersandutm_source=impactandutm_campaign=1310690andutm_content=b2c	components that protect organizations from cybersecurity attacks. Additionally, it addresses database vulnerabilities and provides the tools and knowledge necessary to identify vulnerabilities in various databases, including SQL Injection, Oracle, Mongo, and Couch.
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Online courses in English	Link	Summary
1. Mathematics and computer science for programmers	<a href="https://gb.ru/courses/3925">https://gb.ru/courses/3925</a>	This course familiarizes students with the basic concepts of higher mathematics, computer science, and mathematical logic.
2. Fundamentals of computer science and programming	<a href="https://intuit.ru/studies/courses/105/105/info">https://intuit.ru/studies/courses/105/105/info</a>	The first part of the course introduces programming languages, while the second one outlines practical methods for constructing correct small programs. In the third part, participants are introduced to object-oriented programming, the basics of implementing basic data structures, and consideration of small software projects—prototypes of real-life problems.
3. School of Information Security	<a href="https://www.youtube.com/playlist?list=PLdJo1XiUTZPOJ1kSnoKheT7YSyP9FIO">https://www.youtube.com/playlist?list=PLdJo1XiUTZPOJ1kSnoKheT7YSyP9FIO</a>	This course covers essential aspects of cybersecurity, including mobile application security, network security, and operating system security. It delves into the security of binary applications, the principles of virtualization and containerization, and the fundamentals of cryptography.

### Computer science and Software Engineering

Online courses in English	Link	Summary
1. Introduction to Software Engineering	<a href="https://www.coursera.org/learn/introduction-to-software-engineering">https://www.coursera.org/learn/introduction-to-software-engineering</a>	This course provides a basic understanding of software development and programming.
2. Introduction to Computer Science	<a href="https://pll.harvard.edu/course/cs50-introduction-computer-science">https://pll.harvard.edu/course/cs50-introduction-computer-science</a>	This entry-level course teaches algorithmic thinking and effective problem-solving. Topics include abstraction, algorithms, data structures, encapsulation, resource management, security, software development, and web development. Programming languages covered include C, Python, SQL, and JavaScript, as well as CSS and HTML. The course utilizes problem sets from applied areas, such as biology, cryptography, finance, and forensics.
3. Introduction	<a href="https://pll.harvard.edu/">https://pll.harvard.edu/</a>	The course explores the concepts and algorithms

to Artificial Intelligence with Python	course/cs50s-introduction-artificial-intelligence-python	behind modern artificial intelligence and examines the ideas behind technologies such as game engines, handwriting recognition, and machine translation. Through hands-on projects, students learn the theory behind graph search algorithms, classification, optimization, reinforcement learning, and other topics in artificial intelligence and machine learning.
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Online courses in English	Link	Summary
1. Application development in Python	<a href="https://www.youtube.com/playlist?list=PL6pIRXMq5RACy7NhEK4tdLeKxmKmxDIrr">https://www.youtube.com/playlist?list=PL6pIRXMq5RACy7NhEK4tdLeKxmKmxDIrr</a>	This series of courses covers programs in the Python programming language, which in turn involves a wide range of technologies, such as PyQt5, SQLite3, and Selenium.
2. Software Engineering. Analysis, Modeling, Design	<a href="https://stepik.org/course/175415/promo">https://stepik.org/course/175415/promo</a>	This course includes an introduction to analysis and algorithms, business analysis, product analysis, and systems analysis. Additionally, it delves into data analysis, requirements engineering, modeling, design, and interface design.
3. Fundamentals of Software Engineering	<a href="https://www.lektorium.tv/course/22846">https://www.lektorium.tv/course/22846</a>	This course explores key aspects of software development and management, focusing on the software life cycle, requirements management, and ensuring software quality. It also addresses methods for maintaining and improving software quality, as well as best practices for documenting software systems.

### Computer Science, Hardware, and Architecture

Online courses in English	Link	Summary
1. Computer Architecture	<a href="https://www.coursera.org/learn/comparch">https://www.coursera.org/learn/comparch</a>	Within this course, participants learn to design the computer architecture of complex modern microprocessors.
2. Computer Architecture	<a href="https://www.codecademy.com/learn/computer-architecture">https://www.codecademy.com/learn/computer-architecture</a>	This course covers the basic physical components of a computer, the significance of 0 and 1 in computing, and how instruction set architecture links hardware and software components. It teaches computer architecture, including how a computer operates and data-level parallelism. By the end of the course, students create their own CPU simulator using Python.
3. Introduction to Computer Science	<a href="https://pll.harvard.edu/course/cs50-introduction-">https://pll.harvard.edu/course/cs50-introduction-</a>	This entry-level course teaches algorithmic thinking and effective problem-solving. Topics include abstraction, algorithms, data structures,

	computer-science	encapsulation, resource management, security, software development, and web development. Programming languages covered include C, Python, SQL, and JavaScript, as well as CSS and HTML. The course utilizes problem sets from applied areas, such as biology, cryptography, finance, and forensics.
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<b>Online courses in English</b>	<b>Link</b>	<b>Summary</b>
1. Introduction to computer architecture. Elements of operating systems.	<a href="https://stepik.org/course/253/promo?auth=registration">https://stepik.org/course/253/promo?auth=registration</a>	The main objective of this course is to provide a coherent understanding of the principles of operation of computer technology, both at the hardware and software levels.
2. Computer architecture	<a href="https://stepik.org/course/95983/promo?search=4720854848">https://stepik.org/course/95983/promo?search=4720854848</a>	This course covers the digital logic layer, as well as the microarchitecture, instruction set architecture, operating systems, and assembler layers. It also addresses Intel Core i7, Texas Instrument OMAP4430, and Atmel ATmega16 processors.
3. Fundamental s of computing	<a href="https://stepik.org/course/182244/promo?search=4720854857">https://stepik.org/course/182244/promo?search=4720854857</a>	This course equips students with the skills and knowledge to read and interpret electrical circuit diagrams of typical electronic devices. Participants learn to calculate and select components for standard electronic and digital devices and measure electrical parameters accurately. The course covers the element base and operating principles of both electronic and digital devices, provides foundational knowledge on measuring electrical quantities and instruments, and introduces the components and functions of microprocessor systems and microcontrollers.

### Telecommunications

<b>Online courses in English</b>	<b>Link</b>	<b>Summary</b>
1. Introduction to Computer Science and Programming	<a href="https://www.coursera.org/specializations/introduction-computer-science-programming">https://www.coursera.org/specializations/introduction-computer-science-programming</a>	The course covers topics ranging from the basic principles of computing to the mathematical foundations required for computer science. Participants learn fundamental concepts of computer operation that can be applied to any software or computer system, acquiring the practical skills needed to write interactive graphics programs at the entry level. The Numerical Mathematics component provides the computational tools needed for problem-solving and modeling at different stages of your computer science studies.

PROGRAM

2. AWS: Network Management and Operations	<a href="https://www.coursera.org/learn/aws-network-management-and-operations">https://www.coursera.org/learn/aws-network-management-and-operations</a>	Offering both theoretical and practical knowledge, this course covers the design and implementation of hybrid IT network architectures at scale. Participants also have the opportunity to evaluate routing policies for hybrid IT architectures.
3. Network security and database vulnerabilities	<a href="https://www.coursera.org/learn/network-security-database-vulnerabilities?irclid=ySGUMowi5xyKU1W3AATB6SLIUkC22aVcNwSq0g0andirgwc=1andutm_medium=partnersandutm_source=impactandutm_campaign=1310690andutm_content=b2c">https://www.coursera.org/learn/network-security-database-vulnerabilities?irclid=ySGUMowi5xyKU1W3AATB6SLIUkC22aVcNwSq0g0andirgwc=1andutm_medium=partnersandutm_source=impactandutm_campaign=1310690andutm_content=b2c</a>	This course provides the foundation needed to understand the fundamentals of network security. It covers local area networks, TCP/IP, the OSI structure, and routing basics, explaining how network technologies affect security systems within an organization. The course also examines the network components that protect organizations from cybersecurity attacks. Additionally, it addresses database vulnerabilities and provides the tools and knowledge necessary to identify vulnerabilities in various databases, including SQL Injection, Oracle, Mongo, and Couch.

Online courses in English	Link	Summary
1. Mathematics and Computer Science for Programmers	<a href="https://gb.ru/courses/3925">https://gb.ru/courses/3925</a>	This course familiarizes students with the basic concepts of higher mathematics, computer science, and mathematical logic.
2. Network Administration Basics	<a href="https://stepik.org/course/59837/promo?search=4720854850">https://stepik.org/course/59837/promo?search=4720854850</a>	This course explores the physical foundations of computer technology and information transmission media. Students learn to describe the key components of computer networks and understand their functions. The course covers the principles of network construction, network-level control protocols, and the installation and configuration of operating systems. Practical skills include using the Cisco Network Simulator Packet Tracer, installing and configuring Windows Server, and working with Oracle VM VirtualBox.
3. School of Information Security	<a href="https://www.youtube.com/playlist?list=PLDJo1XilUTZPOJ1kSnoKheT7YSyP9FIO">https://www.youtube.com/playlist?list=PLDJo1XilUTZPOJ1kSnoKheT7YSyP9FIO</a>	This course covers mobile application security, network security, and operating system security. It explores the security of binary applications, virtualization, and containerization. Students learn about incident investigation techniques and cryptography. The course provides a comprehensive understanding of contemporary security challenges and solutions across different technological environments.