

Educational content

Group E (4-5th grade) (11 – 12 year old)

1. C++ Programming Environment. Simple data types. Input and Output.
2. Control structures and operations in the C++ . Conditional statement.
3. Cycles. Embedded cycles. Functions in C++. Strings.
4. Tasks related to dates and time.
5. Concept of a one-dimensional array.

Group D (6-7th grade) (13 – 14 year old)

1. One-dimensional arrays and basic tasks with them. Introduction to Sorting Algorithms. Tools for strings and searching.
2. Divisibility of numbers. Euclid's algorithm and its applications. Prime numbers. Sieve of Eratosthenes. Numeral systems.
3. Implementation for long numbers. Random numbers.
4. Two-dimensional arrays and table information processing. Structures in C. Arrays of structures.
5. Initial knowledge in computer geometry. Rectangles with sides, parallel to the coordinate axes. Square meshes, labyrinths and regions.
6. Standard library (including introduction to STL) and STL sorting tools.
7. Data structure: stack and queue.
8. Concept of recursion. Backtracking.
9. Fast algorithms for searching.
10. Introduction to Dynamic Programming.

Group C (8th grade) (15 year old)

1. Extended Euclid's algorithm and applications.
2. Games with strategies, concerning parity and symmetry. Combinatorial games. Nim. Board games.
3. Bitwise operations and applications.
4. Dynamic programming: one-dimensional and two-dimensional tasks. Longest common subsequence. Shortest supersequence.
5. Graphs: presentation and traversal (DFS, BFS). Directed graphs. Shortest path in graphs. Binary trees and trees for search. Pyramid data structure.
6. Algorithmic geometry: oriented triplet of points and applications.
7. Combinatorial configurations and counting.
8. Arithmetic expressions: representation, computation and transformation.

Group B (9th-10th grade) (16 – 17 year old)

1. STL Library: Containers and iterators, basic algorithms. Hashing.
2. Permutations: basic properties. Combinatorial configurations: encoding and decoding. Numbers of Catalan. Structures for representation of sets. Gray's codes. Decomposing of sets and numbers.
3. Algorithmic geometry: mutual position of points and straight lines. Polygons. Convex hull. Closest and most distant points. Diagrams of Voronoy.
4. Graphs: Bi-connectivity, strong connectivity, Euler tours and Hamilton cycles, Minimum spanning trees, matching in graph, critical path method, Maximum flow. Coloring. Planar graphs. Geometric graphs. Complex tree structures: Fenwick tree, segment trees.
5. Dynamic Programming: Profiles. Recurrent relations and recursion. Conversation of recursive programs.
6. Strings: search by pattern, distances. Effective structures and algorithms for strings. Data Compression: Huffman Codes. Formal grammars and automata.
7. Games: minimal strategies, alpha-beta pruning. Reactive games.
8. Systems of linear equations and integer solutions.

Group A (11th-12th grade) (18-19 year old)

1. All materials from the previous groups combined in complex tasks of the level of the IOI.