Your Course Syllabus

CODDY - International Coding and Design School for Teens and Kids

Olympiad programming for students Course. Module 1

Learning goals are to develop algorithmic thinking, logic, and acquire skills in solving Olympiad problems using Python programming.

Course Syllabus:

Day one

Variables and operators in Python

- Introduction to Python: getting to know the language, its features and advantages in competitive programming;
- Getting to know the VSCode development environment;
- Basic concepts: data types, variables, constants, operations.

Lesson result: got a basic understanding of the Python language.
Practical task: solve the problem of finding the sum of two numbers A and B.

Day two

Conditional operators: if, else. Working with input and output

- Input/output in Olympiad problems;
- Comparison operators;
- Conditional operator if.

Lesson result: learned how to use the conditional operator to solve Olympiad problems.
Practical task: solve problems using the conditional operator.

Day three

For and while loops

- For loops and the concept of range;
- While loop and working with counters;
- Multiple input.

Lesson outcomes: studied the concepts of for and while loops, learned to understand which loop is best to use to solve a specific problem.
Practical task: solve problems using for and while loops.

Day four

Selection of tasks (contest) for the module

- Tournament on the material covered;
- Analysis and explanation of the tournament tasks.

Lesson outcome: knowledge of the main language structures was checked, gaps in knowledge were identified and eliminated.
Practical task: solve tournament tasks, complete the remaining or additional tasks.

Your Course Syllabus

CODDY - International Coding and Design School for Teens and Kids

Olympiad programming for students Course. Module 2

Learning goals are to develop algorithmic thinking, logic, and acquire skills in solving Olympiad problems using Python programming.

Course Syllabus:

Day one

Lists in Python

- The concept of an array;
- Explanation of how static and dynamic arrays work;
- The importance of an array as a basic data structure.

Lesson outcome: learned what an array is and its necessity in solving Olympiad problems.
Practical task: solve problems that use an array.

Day two

Functions in Python

- Concept of functions in programming;
- Working with functions, function arguments;
- Working with built-in libraries.

Lesson outcome: studied the concept of functions and learned how to work with them.
Practical task: solve problems using built-in and native functions.

Day three

Working with strings in Python

- The concept of a string;
- Basic functions for working with strings;
- Formatted output.

Lesson outcome: learned how to work with strings and output the answer in the required format.
Practical task: solve problems using strings.

Day four

Selection of tasks (contest) for the module

- Tournament on all topics covered;
- Analysis of tasks.

Result of the lesson: knowledge of language syntax was checked and errors were corrected.
Practical task: solve tournament tasks, complete the remaining exercises.

Your Course Syllabus

CODDY - International Coding and Design School for Teens and Kids

Olympiad programming for students Course. Module 3

Learning goals are to develop algorithmic thinking, logic, and acquire skills in solving Olympiad problems using Python programming.

Course Syllabus:

Day one

Asymptotics of solutions. Big O notation

- Analysis of program performance;
- Big O notation;
- Analysis of problem constraints.

Lesson outcome: learned what asymptotics is and how to evaluate it, learned how to select an algorithm that fits the problem constraints.
Practical task: evaluate asymptotics and select the necessary algorithm for solving problems.

Day two

Arithmetic

- Basic number theory;
- The concept of parity;
- The concept of divisibility, remainders from division.

Lesson outcome: we understood how to see and solve problems on basic number theory.
Practical task: solve problems on the topic of arithmetic.

Day three

Sorting

- Why sort an array;
- Basic sorting (BubbleSort, MergeSort, QuickSort);
- Working with built-in sorting.

Lesson outcome: studied basic and built-in sorting algorithms.
Practical task: solve sorting problems.

Day four

A selection of tasks (contest) on the basics of algorithms

- Virtual tournament on the topics covered;
- Analysis and solution of problems.

Lesson outcome: knowledge of the topics covered was checked.
Practical task: solve tournament problems, complete the remaining problems.

Your Course Syllabus

CODDY - International Coding and Design School for Teens and Kids

Olympiad programming for students Course. Module 4

Learning goals are to develop algorithmic thinking, logic, and acquire skills in solving Olympiad problems using Python programming.

Course Syllabus:

Day one

Search algorithms

- Linear search;
- Binary search;
- Binary search by answer.

Lesson outcome: studied the concept of binary search and learned to see it in problems.
Practical task: solve problems on binary search and binary search by answer.

Day two

Recursion

- The concept of recursion;
- Examples of recursive approaches: factorial and Fibonacci numbers;
- Recursive algorithms.

Lesson outcome: studied the concept of recursion, learned to solve basic problems on recursion.
Practical task: solve problems on the topic of recursion.

Day three

Sets and Dictionaries

- Concepts of a set and a dictionary;
- Studying the principles of a dictionary and a set;
- Using a dictionary and a set to solve problems.

Lesson outcome: studied the concept of a set and a dictionary, understood how and when they should be used to solve problems.
Practical task: solve problems on the topic of sets and dictionaries.

Day four

A selection of tasks (contest) on basic data structures and algorithms

- Virtual tournament on the topics covered;
- Analysis of unsolved problems.

Lesson outcome: knowledge of the material covered was tested.
Practical task: solve tournament problems, analyze and complete unsolved problems.

Your Course Syllabus

CODDY - International Coding and Design School for Teens and Kids

Olympiad programming for students Course. Module 5

Learning goals are to develop algorithmic thinking, logic, and acquire skills in solving Olympiad problems using Python programming.

Course Syllabus:

Day one

Greedy algorithms

- Problems with choosing a locally optimal solution. Basics of greedy approaches;
- Examples of problems on minimization and maximization.

Lesson outcome: studied the concept and examples of greedy algorithms and learned how to apply them.
Practical task: solve problems using greedy approaches.

Day two

Number Theory

- Prime numbers;
- Least common divisor (GCD), Least common multiple (LCM);
- Euclidean Algorithm;
- Extended Euclidean Algorithm.

Lesson outcome: learned the concept of GCD and LCM and learned how to find them quickly.
Practical task: solve problems in number theory.

Day three

Introduction to the Olympiad movement. Analysis of Olympiad problems

- How and when to participate in Olympiads? How to prepare and perform well?
- Analysis of VSOSh/MOSh problems;
- Explanation of the testing system.

Lesson outcome: familiarized ourselves with the options of real Olympiad problems and understood the nuances of the testing system.
Practical task: to solve the Olympiad problems.

Day four

A selection of tasks (contest) on advanced algorithms

- Virtual tournament on the topics covered;
- Analysis of unsolved problems.

Lesson outcome: knowledge of the material covered was tested.
Practical task: solve tournament problems, analyze and complete unsolved problems.

Your Course Syllabus

CODDY - International Coding and Design School for Teens and Kids

Olympiad programming for students Course. Module 6

Learning goals are to develop algorithmic thinking, logic, and acquire skills in solving Olympiad problems using Python programming.

Course Syllabus:

Day one

Stack, queue, deque

- The concept of a stack, queue and deque;
- The difference in approaches to choosing a data structure;
- Why you can't use deque everywhere.

Lesson result: learned what a stack, queue and deque are, their differences, learned how to use these structures.
Practical task: solve problems using the studied data structures.

Day two

Combinatorics

- Permutations and combinations;
- Pascal's triangle;
- Sieve of Eratosthenes.

Lesson outcome: got acquainted with basic combinatorics and delved into number theory.
Practical task: solve problems in combinatorics.

Day three

Dynamic programming: basics

- Basics of dynamic programming;
- Dynamic programming problems (Fibonacci numbers, factorial);
- Dynamic approaches.

Lesson outcome: learned what dynamic programming is and why it is important.
Practical task: solve problems using dynamic approaches.

Day four

Selection of tasks (contest) for the module

- Virtual tournament on the topics covered;
- Analysis of tasks.

Lesson outcome: knowledge of the material covered was tested.
Practical task: solve tournament tasks, analyze and complete unsolved tasks.

Your Course Syllabus

CODDY - International Coding and Design School for Teens and Kids

Olympiad programming for students Course. Module 7

Learning goals are to develop algorithmic thinking, logic, and acquire skills in solving Olympiad problems using Python programming.

Course Syllabus:

Day one

Graph Theory

- What is a graph;
- Types and properties of graphs;
- Matrix and adjacency list.

Lesson outcome: got acquainted with the concept of a graph and ways of its representation in a program.
Practical task: solve simple problems on graphs.

Day two

Depth-First Search (DFS)

- Why do we need DFS?;
- How DFS works;
- DFS modifications.

Lesson outcome: we learned what DFS is, why we need it, learned how to use it and its modifications when solving Olympiad problems.
Practical task: solve depth-first search problems.

Day three

Breadth-First Search (BFS) Algorithm

- BFS operating principles;
- Differences between DFS and BFS approaches;
- BFS modifications.

Lesson outcome: familiarized with the BFS algorithm, learned how to use it and its modifications when solving Olympiad problems.
Practical task: solve breadth-first search problems.

Day four

Selection of tasks (contest) by graphs

- Virtual tournament on the topics covered;
- Analysis of tasks.

Lesson outcome: knowledge of the material covered was tested.
Practical task: solve tournament tasks, analyze and complete unsolved tasks.

Your Course Syllabus

CODDY - International Coding and Design School for Teens and Kids

Olympiad programming for students Course. Module 8

Learning goals are to develop algorithmic thinking, logic, and acquire skills in solving Olympiad problems using Python programming.

Course Syllabus:

Day one

Analysis of international olympiads (IOI, ICPC)

- Analysis of IOI/ICPC variants;
- Analysis of complex problems from competitions;
- Analysis of non-standard solutions.

Lesson outcome: got acquainted with the problems of international olympiads and trained the ability to find non-trivial solutions.
Practical task: solve problems from olympiads.

Day two

Two pointers and solution optimization

- Two pointer method;
- Advantages of the two pointer method over greedy approaches;
- Solution optimization techniques.

Lesson outcome: studied solution optimization methods and the two pointer method, saw the advantage of the method over greedy algorithms.
Practical task: solve problems with two pointers.

Day three

Geometry

- Distance calculation;
- ScanLine algorithm;
- Other geometric problems.

Lesson outcome: learned about the scanning line method and learned to use school knowledge of geometry in programming.
Practical task: solve geometric problems.

Day four

Final tournament

- Final virtual tournament;
- Analysis of tasks;
- Summing up.

Result of the lesson: checked knowledge of the material covered, summed up the course, received recommendations on further steps in preparing for the Olympiads.
Practical task: prepare for the Olympiads and solve tasks.