

# Competitive Programming with Java

Presented by AcademiaEdge

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Assistant Teacher: Raghav Sriram (10th)

Date and Timing: 2/19 - 5/7 on Friday from 8-9 P.M. EST

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**Requirements:** Students must have a personal Gmail account to access google classroom and class materials. Recommended for students ages 11 and up. But any student may join if interested.

## Class Description:

In this class, I'm going to use the following [Textbook](#), written by USACO Platinum contestant Darren Yao. All reading assigned for Homework is from this textbook. The textbook is **packed** with information, so I won't assign much reading at a time. However, I highly recommend you read the textbook slowly and re-read confusing paragraphs if necessary. Students can ask questions at any time during the class and the assistant or teacher will answer them. Additionally, students may message teachers via google classroom or by email and our teachers will respond as soon as possible. In order to give this individualized experience filled with fun projects and assignments guided towards students, classes will be limited to 10-20 students so that teachers can give high-quality attention to each student. Sign up is first come first serve and a waitlist may be created if there is excessive student participation. This course will be guided towards students of grades 6 and up, but any student may join if interested. We can't wait to help your child create their own website!

**Notes about Difficulty:** These are not an absolute difficulty, but merely the difficulty of solving each problem based only on what we've covered in class up to this point. The scale I use is very easy (1), easy (2), medium (3), hard (4), very hard (5).

# Syllabus:

## First Class Schedule:

15 minutes	What is Competitive Programming and what is the USACO?
15 minutes	Setting up the Java IDE. Talking about “standard in” and “standard out”.
10 minutes	Analyzing a sample problem
5 minutes	Summary

## Second Class Schedule:

20 minutes	An overview of Efficiency and Time Complexity.
20 minutes	Fundamental types: integer, long, double, character, string
5 minutes	Summary

## General Class Schedule:

10 minutes	Review last weeks homework + Questions
15-20 minutes	Lecture
20 minutes	Problem Discussion and Collaborative Problem Solving
5 minutes	Summary and Assign Homework

### Third Class Schedule:

10 minutes	Review last week's homework
10 minutes	Fundamental Data Structures: Arrays, ArrayLists, Stacks, Queues, Deques, Priority Queues + Applications
5 minutes	Sorting Custom Comparators
20 minutes	Work on <i>Dragons and Princesses</i>
5 minutes	Summary

### Fourth Class Schedule:

10 minutes	Review last week's homework
15 minutes	Sets and Maps: HashSet, HashMap, TreeSet, TreeMap, MultiSet
20 minutes	Collaborative Problem solving
5 minutes	Summary

# Course Content

1. Introduction to Competitive Programming with Java
  - a. What is Competitive Programming (CP)?
  - b. What is the USA Computing Olympiad (USACO)?
  - c. Useful Websites and Practice Problem Archives
2. The Fundamentals
  - a. Time Complexity Analysis
  - b. Fundamental types in Java (integer, long, string, etc.)
3. Fundamental Data Structures
  - a. Arrays, ArrayLists
  - b. Stacks, Queues, Deques
  - c. Sorting in Competitive Programming and Priority Queues
  - d. Challenge Problem! *Dragons and Princesses*
4. Sets and Maps I
  - a. HashSets and HashMaps
  - b. TreeSets and TreeMap
  - c. MultiSets
  - d. Practice problems
5. Sets and Maps II
  - a. Practice problems
6. Implementation and Simulation I
  - a. An introduction to Algorithmic Thinking
  - b. Breaking down the problem
  - c. Halfway point review
7. Implementation and Simulation II
  - a. Practice problems
8. Implementation and Simulation III
  - a. Practice problems
9. Basic Algorithms: A Guide to Brute Force
  - a. A guide to “greedy” algorithms

- b. Generating algorithms (including generating permutations)
  - c. Practice problems
- 10. Brute Force II
  - a. Practice problems
- 11. Geometry in Competitive Programming
  - a. The coordinate plane
  - b. Finding squares and rectangles
  - c. Various kinds of distance
  - d. Practice problems
- 12. Basic Graph Theory and Review
  - a. What is a “graph”?
  - b. Working with graphs in Java
  - c. Class summary

# Rules and Expectations

## **Classroom Procedures:**

Students are to stay muted at all times except if they have a question or when asked to be unmuted. The student may temporarily unmute himself to ask his/her question. Alternatively, if the student would not like to speak in front of the class, then the student may ask his/her question in the Zoom chat. We encourage students to ask questions and regularly participate in class. Also, we would like students to be respectful to their classmates and teachers.

Students, please do not:

- Eat or drink with your microphone turned on
- Be disrespectful to teachers or other students
- Put inappropriate pictures on your webcam
- Send inappropriate messages in the class chat

Please do:

- Ask questions
- Be attentive
- Be engaged and active throughout the class
- Make sure to have your camera on throughout the class
- Do assignments thoroughly
- Submit assignments before the deadline
- Have Fun!

## **Google Classroom Layout:**

Each lesson's recording will be found on google classroom along with the class's slides and notes. Homework assignments will be assigned and submitted via google classroom as well. Students can ask questions through the messaging system in google classroom or via email.

## **Homework procedures:**

Students will be given homework in google classroom via google docs, which will consist of inserting screenshots or short-answer/multiple-choice questions, or google forms. The google forms will mainly be used for knowledge checks, while the google docs will be used for general homework assignments. Each assignment is due 24 hours before the next class to give ample time for teachers to grade students' assignments. Students should send a message or an email if they are unable to turn in their homework by then with a valid explanation of why they will not be able to turn in their homework by the deadline, and the teachers will come up with a possible solution. This also applies to missing a class. Course projects will also be assigned and submitted through Google Classroom. If a student misses an assignment deadline repeatedly an email will be sent to his/her parents.