2021 USACO Bronze Summer Class

Objectives

The class is to help students for their USACO contest preparation. It is for those who are interested in participating but have very little or no prior experience in USACO contests and/or competitive programming. We will discuss a series of topics on programming basics, computer algorithms, data structures and problem solving strategies. It can also be a good introduction to competitive programming for those who have no current participation plan but intend to extend knowledge in computer algorithms, data structures and problem solving strategies.

Schedule

6-8 sessions on Fridays 5:30-7:30 PM CDT from Jun 4th, 2021 through Jul 23, 2021:
Friday Jun 11th, 2021 5:30-7:30 CDT
Friday Jun 18th, 2021 5:30-7:30 CDT
Friday Jun 25th, 2021 5:30-7:30 CDT
Friday Jul 9th, 2021 5:30-7:30 CDT
Friday Jul 16th, 2021 5:30-7:30 CDT
Friday Jul 23th, 2021 5:30-7:30 CDT
Friday Jul 30th, 2021 5:30-7:30 CDT (Reserved for make up lesson upon students and instructor's availability)

Placement Exam

Students are expected to pass our online placement exam with 8 problems at the following link: https://www.hackerrank.com/pyramid-academy-coding-contest-pilot. The exam is hosted by HackerRank.com with their online code judge system. Each problem is in the same format as the other coding challenges provided by HackerRank.com. There are problem descriptions that introduce the problem. The solution is required to consume input data from standard input with the specific instructions provided, and produce output data to the standard output in the expected format. The online code judge system compares the solution outputs against a suite of expected output cases. The solution should pass all the test cases to be fully accepted. Please complete the exam within one week at one's best convenience. Students can provide multiple submissions but only the very last one will be used in the final scoring. In order to secure one's enrollment, a student must pass 6 out of the total 8 problems, subject to availability.

Prerequisites

Students would be better to be fluent in one of the following three programming languages ideally for better preparation results:

- Python3
- Java
- C++11/17

For the above mentioned languages, students are expected to have good understanding and be fluent with the following language synopsis:

- Data types: integers, decimals, and strings
    - Knowledge of literals and variables
    - Knowledge of data type limits for integers and decimals
    - Knowledge of binary, decimal and hexadecimal formats
- Operators and expressions
    - Knowledge of arithmetic and logical operators
    - Able to compose complex expression with multiple operators and operands
- Conditions: if-else and switch/case (when applicable)
    - Able to use nested if-else statements
    - Able to use combined statements and knowledge of scopes
- Loops
    - for-loop, while-loop
    - Able to use multi-layer nested loops
- Functions
    - Able to define and invoke regular functions
    - Able to define and invoke methods of classes
    - Able to define and invoke recursive functions
- Basic object-oriented
    - Basic encapsulations is enough: able to define simple classes with simple properties and methods with access modifiers
    - Knowledge of basic usage for classes and objects
- Knowledge of standard libraries
    - Able to define and use arrays, dynamic arrays
    - Able to define and use multidimensional arrays will help but not required
- Basic standard I/O and file I/O: able read/write integers and strings from/to simple text files
- Basic string processing: knowledge and experience in parsing integers from strings and formatting integers into strings, access characters in the strings

Online Classroom

Here is our zoom meeting information:
Zoom Meeting Link:
https://us02web.zoom.us/j/5869808202?pwd=SWZoU1pUT1h4Y2hRYy9uRXdMWXdhZz09
Zoom meeting #: 586 980 8202
Password: 0421#2

Preparation

Students should prepare the following before a lesson:
- Have a dedicated computer with stable internet access
- Install Zoom Meetings
- Install and be familiar with a compiler or interpreter program for students preferred languages

Topics Covered

There might be adjusted topics added/removed from the following:
- Introduction to Competitive Programming & USACO contests
- Asymptotic Complexity, mostly Time Complexity
- Arrays
  - Static and dynamic arrays
  - Matrices: multi-dimensional arrays
- Trees
  - Concepts of Trees Binary Trees, Binary Search Trees
  - Usage of standard libraries
- Hash-table
  - Concepts of Hash-tables
  - Usage of standard libraries
- DFS & BFS
- Complete Search
  - Iteration vs. Recursion
  - Backtracking
    - Chess Queen Problem
    - Permutations
    - Combinations
    - Lexicographical order
- Solving Geometry & Cartesian Coordinate System Problems

- - - Matrices representations
    - Depth First Search (DFS) on matrices (optional)
    - Breadth First Search (BFS) on matrices (optional)
- Introduction to Intuitive Greedy Algorithms
- Introduction to Graphs
  - Vertices and edges, Directed vs. Undirected, Paths & Cycles
  - Implementations
    - Adjacency Matrices
    - Adjacency Lists