Tech Interview Prep

Lecture 1

Christian Yongwhan Lim
Tuesday, September 5, 2023

Christian Yongwhan Lim

Education

Stanford University

Part-time Jobs

Full-time Job

Google Research

TWO SIGMA

Workshops

Stanford ENGINEERING | Stanford Computer Forum

Coach/Judge

icpc International Collegiate Programming Contest

icpc.foundation

advancing the art and sport of competitive programming

https://www.yongwhan.io

Instructor's (Terse) Background

- **Email**: yongwhan.lim@columbia.edu

- **Associate in Computer Science** at Columbia;
- **ICPC Head Coach** for Columbia University;
- **Internship Manager** at ICPC Foundation;
- **ICPC North America Leadership** Team;
- **CEO** (Co-Founder) in a Stealth Mode Startup;
- **Owner** in Christian and Grace Consulting LLC;
- **Visiting Instructor** at Cornell-Tech;

https://www.yongwhan.io

Wonderful TAs!

- **Akash Nayar**
  - Email: akn2120@columbia.edu
  - Administrative tasks (e.g., auto-grading, etc)

- **Suro Lee**
  - Email: sl5203@columbia.edu
  - Office Hour: **Thursdays**, from **4pm ET** to 5pm ET @ Mudd 1st floor

Akash Nayar (TA)

- SEAS Senior
- 1.5 years of Competitive Programming experience
- Interested in Machine Learning and AI
- Python -> C++ convert (for CP)

Suro Lee (TA)

- 2nd Year MSCS Student
- Previously a SWE at Samsung
- Interested in ML, Competitive Programming, and anything else that will get me a full-time job

Wonderful Course Designer!

- **Grace Lim**
  - Email: gc3000@columbia.edu

Grace Lim (Course Designer)

- GS Junior
- Worked in Google before: at Google Play for ~4 years.
- Won a t-shirt from TopCoder Open before.
- I love CS and Psychology!
- Will bring a lot of enthusiasms here!

NOW... IT IS ABOUT YOU!

- Please fill out a survey on https://bit.ly/tech-prep-survey

NOW!

- I will give you **few minutes** to fill out the survey :)

Lectures

- **Tuesdays** and **Thursdays** from **5:40pm ET** to 6:55pm ET
- @ **1024 Seeley W. Mudd**, in-person only!
- All course materials will be posted on Columbia Courseworks: https://courseworks2.columbia.edu/courses/179361

Prerequisites

- **COMS 3134** (Data Structure in Java) or
- **COMS 3136** (Essential Data Structures in C/C++)

AND

- **COMS 3157** (Advanced Programming)

- Please talk to me if you have any questions.

Instructor's Office Hours

- Mondays, from 4:30pm ET to 5:30pm ET
- @Adjunct's Office in CEPSR 7th floor

Request 1:1 Meeting, through Calendly

- Use https://calendly.com/yongwhan/quick-chat-blitz to request 1:1 meeting.
- Barring extraordinary circumstance, please use time slot **between 9am ET and 9pm ET**; if you have an exceptional case, please send me an email (yongwhan.lim@columbia.edu) to describe the issue. thank you!

- If you would like to be considered for a recurring one, please fill out this form.

Optional Textbooks

- Elements of Programming Interviews (2nd edition) is a great textbook to have, but not mandatory.

(Growing) Short List of Useful Websites

- Please take a look as needed: **Link**

Terse Guides

- Please take a look as needed: **Link**

Course Objectives

- Master the fundamental knowledge required to succeed in any entry-level technical interview at the top-tier IT companies (MAANG or equivalent).
- Learn about a life as a software engineer.
- Touch on some system design and behavioral interview questions.

Allowed Languages

- C/C++
- Python
- Java

Assignments

- **LIVE LeetCode** programming contests
  - Weekly contests
  - Biweekly contests

- **TechPrep AI Daily Challenge** (https://techprepai.vercel.app)
  - Tracking will start only on **Saturday, September 16, 2023**.
  - Please join its discord server via https://discord.gg/USZn5Xqccb.

Assignment Points

- **LeetCode Live Contests**:
  - Consulting external resources is forbidden.
- **TechPrepAI**:
  - Consulting external resources is allowed, but only with **proper citation**.
- 1 point per accepted submission.
- A maximum of 1 point per question.
- You will get a full-mark in the assignment portion of the final grade if you attain **150** points throughout the semester.

Proper Citation

- As written explicitly in **"Course Contract"**,
- If you refer to an additional resource, you **MUST** cite the source using comments.
- To put the citation at the top of the code,
  - In C++, for example, you MUST use "//" or "/* */".
  - In Python, you MUST use '#".
- **Take a special care with the proper citation as, there is:**

NO EXCEPTION TO THIS CITATION RULE

- Failure to abide by the rules above will result in automatic failure in this class. In addition, you will be referred to the office.

Deliverables

- Your submissions in LeetCode and TechPrep AI will be auto-tracked.

- So, you do not have an explicit deliverable apart from **consistently doing** LeetCode contest and daily challenge from TechPrep AI.

NO EXAM

- No midterm!
- No final!

Course Structure

- **Requirement**
  - On Tuesdays and Thursdays, there will be a 75-minute in-person lecture.
  - On Saturdays, there will be a LeetCode online contest, weekly or biweekly.
  - Starting the day after the drop deadline (Saturday, September 16, 2023), there will be a Daily Challenge from TechPrep AI.
- **Optional**
  - On Mondays, there will be a weekly problem set in CodeForces.
  - On Fridays, there will be a weekend problem set in CodeForces.

Module Breakdown

- **Module I** (3 weeks): a highlight of key points; go through example problems; students can volunteer for extra credit.
- **Module II** (5 weeks): a short presentation where each student needs to do at least one; failure to present would result in automatic F on the course.
- **Module III** (5 weeks): a mini (mock-) interview where each student needs to do at least one; critique others when not actively interviewing; failure to do an interview would result in automatic F on the course.

ICPC North America Qualifier (NAQ)

- **Highly recommended!**
- **In-person ONLY**
- **Sunday, September 30, 2023**.
- **Location: TBD**
- You will receive assignment points equivalent to the number of solutions you correctly solved, if you successfully participate in this contest.
- This is an individual, not a team, contest.
- If you do well, this will be used to form your team to represent Columbia at the Greater New York ICPC Regionals.
- To express your interest on participation, please use this form.

ICPC Columbia University Local Contest (CULC)

- **Highly recommended!**
- **In-person ONLY**
- **Sunday, September 25, 2022 from 1pm to 6pm**.
- **Location: TBD**
- You will receive assignment points equivalent to the number of solutions you correctly solved, if you successfully participate in this contest.
- This is an individual, not a team, contest.
- If you do well, this will be used to form your team to represent Columbia at the Greater New York ICPC Regionals.
- To express your interest on participation, please use this form.

Grade Breakdown

- **60%**: Assignment:
  - Your points out of 150 points

- **40%**: Participation:
  - 50%: Presentation (Module II)
  - 50%: Mock Interview (Module III)

Automatic Failure Modes

- Here are the modes in which the final grade will result in automatic failure of the course:
  - Failure to present in the lecture;
  - Failure to participate in the contest;
  - Failure to attend the lecture;
  - Failure to adhere to Course Contract;
  - Failure to submit Course Contract;

More on Course Syllabus!

- Please take a look at the syllabus carefully, as some important additional information is covered in the syllabus such as:
  - Grade Distribution;
  - Policy on Academic Honesty;
  - Detailed Lesson Plan and Key Dates;

Important Note

- Do **NOT** be AFRAID to ask! I **love** students asking questions.
- I am here to make you all succeed in this class and in the actual interview.
- You can think of me as a **coach** rooting for your success in life.
- Let's pull this through together; I will lead you through this journey!

Questions so far?

- If not, let's finish up the lecture by diving into the "light" technical topic: **what really is the technical interview?**

Interview

- There are generally two types of interview: **technical** and **behavioral**.
- This course will focus on **technical** interview.
- However, we will briefly cover behavioral one for completeness in Module II.

Technical Interview

- There are recruiter call, 0-1 online coding challenge, 2-3 technical phone screens, 4-7 onsite interviews, and 0-5 fit calls and negotiation.
- There are two types:
  - **data structures and algorithms (DSA)**
  - system design problems

- Assuming most people are going for entry-level, we will mainly focus on DSA.

Interview Topics

Fundamentals

- Primitive Type
- Array & Linked List
- Binary Tree
- Heap
- Sorting

Important

- **Stack & Queue**
- **Hash Table**
- **Binary Search Tree**
- **Searching**
- **Recursion**

Real Differentiators

- **String**
- **Dynamic Programming**
- **Greedy Algorithm and Invariant**
- **Graph**

Primitive Type

- int, long long, double, long double, char, float, ... should be very familiar.
- Be comfortable with bitwise operators: NOT, XOR, OR, and AND.
- Make sure to know how **bit-masking** works.

Logical Operators

p	q	NOT p ~p	p XOR q p ^ q	p OR q p | q	p AND q p & q
1	1	0	0	1	1
1	0	0	1	1	0
0	1	1	1	1	0
0	0	1	0	0	0

Logical Operators on Numbers

- The numbers should be written in binary first.
- Then, you can apply the logical operator on each bit position.
- For example:
  - If you want to calculate 5 OR 7, you can write:

5	1	0	1
3	0	1	1
5 OR 3	1	1	1

  - So, the result is $111_2 = \mathbf{7}_{10}$

Primitive Type: Question #1

- Reverse a number (in integer data type).
  - Example Input #1: 123
  - Example Output #1: 321

  - Example Input #2: 0
  - Example Output #2: 0

Primitive Type: Answer #1

- Time complexity: O(log n)
- Additional space complexity: O(1)

```
if(n==0)
    return 0;
int ret=0;
while(n) {
    ret=ret*10 + n%10;
    n/=10;
}
return ret;
```

Credit: syntax highlighter is from https://highlight.hohli.com/index.php here and moving forward.

Primitive Type: Question #2

- Given a set of n elements, print all subset of the set.
  - Example Input: {a, b}
  - Example Output:
    - line 1: ""
    - line 2: "a"
    - line 3: "b"
    - line 4: "a b"

Primitive Type: Answer #2

- Time complexity: $O(2^n n)$
- Additional space complexity: O(1)

```
int n = a.size();
for (int i=0; i<(1<<n); i++) {
   for (int j=0; j<n; j++)
      if(i&(1<<j)) cout << a[j] << " ";
   cout<<endl;
}
```

Course Basic Entry Requirement

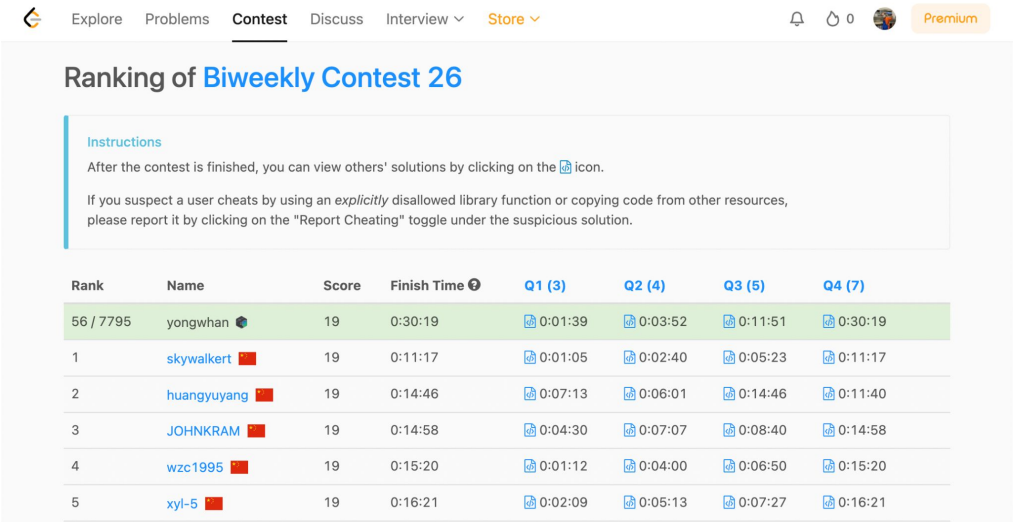
- LeetCode Weekly or Biweekly LIVE Contest 3 problems or more

OR

- LeetCode Weekly or Biweekly LIVE Contest 2 problems with a short 1:1 fit interview with your resume

Course Waitlist

- If you satisfy Basic Entry Requirement, feel free to email me a screenshot that looks something like:



Screenshot Requirement

- Make sure the screenshot is from the ranking page of the contest.
- Your ID should be clearly visible.
- Your rank and finish time should be visible.

Resume vs Referral

- In the current macroeconomic condition, having a good referral is much more important than crafting a "perfect" resume.
- Good referral means:
  - You know the referrer for more than a year (ideally multiple years).
  - Your referrer has 3-5 years more experience than you in the industry.
    - Anyone with fewer years is not so helpful;
    - Anyone with more years is also not so helpful;
- Similar to a letter of recommendation for college or graduate school application.

ICPC World Finals @Egypt!

- Kevin Yang, Kaiheng Dai, and Neal Lai are representing Columbia University in ICPC World Finals at Egypt!

- Due to a travel to Egypt for ICPC World Finals in November, lectures on November 9, 12, 14 will be online, potentially asynchronously.

- I will make sure to clarify how it will work closer to the dates. Thanks for your understanding!


THANK YOU