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# UCF ICPC Training Camp

## Day V: Wrap-Up

Yongwhan Lim  
Saturday, March 25, 2022

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# Yongwhan Lim



## Education



## Part-time Jobs



## Full-time Job



## Workshops



## Coach/Judge



<https://www.yongwhan.io>

# Yongwhan Lim



- Currently:
  - a **Co-Founder** in a Stealth Mode Startup;
  - **ICPC Internship Director**;
  - Columbia ICPC **Head Coach**;
  - ICPC **Judge** for NAQ and Regionals;
  - **Lecturer** at MIT;
  - **Adjunct** (Associate in CS) at Columbia;



<https://www.yongwhan.io>

# Today's Format

10:30am ET - 12pm ET

**Lecture: Wrap-Up**

12pm ET - 12:45pm ET

**Lunch**

# Success Pathways in Zealot Problem Set!

- Those who are just starting should focus on the **first half** of problems in Zealot Problem Set. Your main focus should be gaining some experiences with an explicit goal to enjoy the process of solving new problems and potentially making it to the ICPC North America Championship (NAC)!
- Those who are more serious should focus on the **second half** of problems in Zealot Problem Set. Your goal should be making into the World Finals and potentially winning a medal!
- **Who are in?!**

# Practice Strategy

- If your goal is to get to a rating of **X**, you should practice on problems that are **X + 300** typically, with a spread of 100. So, picking problems within the range of:

**$\{X + 200, X + 300, X + 400\}$**

would be sensible!

- So, if you want to target becoming a **red**, which has a lower-bound of 2400, you should aim to solving  $\{2600, 2700, 2800\}$ .
- **(Eventual) Target:** You should focus on solving it for 30 minutes or less!

# Practice Strategy

- You should focus on solving each problem for **30 minutes or less**; if you cannot solve any problem with this range, you should consider solving a problem with a lower rating.
- You should aim to solve **10 ~ 15 problems** each day within this range to expect a rank up within a quarter (3 months).
- If you cannot solve a problem, here is a sample recipe you can follow:
  - Look at editorial for hints, and try to solve the problem.
  - Look at editorial for full solutions, and try to solve the problem.
  - Look at accepted solutions, and try to solve the problem.
  - Make sure you look back after two weeks and see if you can solve it.

# Request 1:1 Meeting, through Calendly

- Use [calendly.com/yongwhan/one-on-one](https://calendly.com/yongwhan/one-on-one) to request 1:1 meeting:
  - Mock Interview
  - Resume Critique
  - Career Planning
  - Practice Strategy
  - ...
- Always inspired by driven students like yourself!
- Since I'd feel honored/thrilled to talk to you, do not feel shy to sign up!!



# Lecture

# Today's Overview: Wrap Up

- I. UCF ICPC Training Camp Day 1 - 4
  - A. Upsolved: 3J (Andy); 4D (Seba); 4F (Seba);
  - B. Number Theory: **Completed!**
  - C. Combinatorics: 2H; 2J;
  - D. Game Theory: 3I;
  - E. Geometry: 4E; 4G; 4H;
- II. Mobius function implementations
- III. Erwin-Hall distributions
- IV. Where to go from here?

## I-A. UCF ICPC Training Camp Day 3: J (Andy)

## I-A. UCF ICPC Training Camp Day 4: D (Seba)

## I-A. UCF ICPC Training Camp Day 4: F (Seba)

**I-B. UCF ICPC Training Camp Day 1: Done! Awesome!**

# I-C. UCF ICPC Training Camp Day 2: H

- Problem Title: 2-Coloring
  - Rating: **3100**
  - Problem: <https://codeforces.com/problemset/problem/1503/E>
  - Solution: <https://codeforces.com/blog/entry/89319>
- 
- Key terms: binomial coefficient; dynamic programming; symmetry;

## I-C. UCF ICPC Training Camp Day 2: J

- Problem Title: Nezzar and Chocolate Bars
  - Rating: **3500**
  - Problem: <https://codeforces.com/problemset/problem/1477/F>
  - Solution: <https://codeforces.com/blog/entry/87294>
- 
- Key terms:  $n=1$  case vs general case; PDF/CDF; Irwin-Hall; OGF/EGF; NTT;



# I-D. UCF ICPC Training Camp Day 3: I

- Problem Title: A Game on Strings
  - Rating: **3200**
  - Problem: <https://codeforces.com/problemset/problem/1037/G>
  - Solution: <https://codeforces.com/blog/entry/61606>
- 
- Key terms: prefix/suffix; (precomputed) Grundys; range xor;

## I-E. UCF ICPC Training Camp Day 4: E

- Problem Title: Fox and Meteor Shower
  - Rating: **3100**
  - Problem: <https://codeforces.com/problemset/problem/388/E>
  - Solution: <https://codeforces.com/blog/entry/10629>
  - Sample Code: <https://codeforces.com/contest/388/submission/73014645>
- 
- Key terms: sorting; custom comparer; line/3D geometry;

## I-E. UCF ICPC Training Camp Day 4: G

- Problem Title: Geolocation
  - Rating: **3400**
  - Problem: <https://codeforces.com/problemset/problem/1220/G>
  - Solution: <https://codeforces.com/blog/entry/69899>
  - Sample Code: <https://codeforces.com/contest/1220/submission/65795021>
- 
- Key terms: expand summation; re-center;

## I-E. UCF ICPC Training Camp Day 4: H

- Problem Title: Spaceship Crisis Management
  - Rating: **3500**
  - Problem: <https://codeforces.com/problemset/problem/1628/F>
  - Solution: <https://codeforces.com/blog/entry/99276>
- 
- Key terms: slow solution using dp; **Li-Chao** to optimize!

# I. Summary (and lesson learned!)

- **Consistently work with problems that are rated between 3100 and 3500 inclusive in CodeForces on exhaustive topics!**
  - You can do this daily, if you'd like daily, by focusing on the last 5 problems from the daily challenge in **Zealot CodeForces server**.
- **READ ALL THE PROBLEM STATEMENTS** in the first 30 minutes of the contest BEFORE you embark on writing solutions.
  - Especially, for Day 4, the last two problems were much more doable, compared to the rest!
- Enumerate topics and learn who is good on what. I noticed some patterns amongst participants and it is good to make that explicit.

## II. Mobius function implementation

- A lot of your teammates (e.g., camc) already have a great implementation
- For example:  
<https://codeforces.com/group/LgApDmdzKL/contest/434790/submission/198849486>
- Make sure to have common codes in **your library**, instead of having to retype them each time, to save time! (But of course after knowing them)
- So, it seems like (probably) most of you already know this but, just to make sure it becomes a **common knowledge**:

## II. Mobius function implementation

```
const int N = 1e6 + 10;
/**
 * mobius[i] = 0 iff there exists a prime p s.t.  $i \%(p^2) = 0$ 
 * mobius[i] = -1 iff i has an odd number of distinct prime factors
 * mobius[i] = 1 iff i has an even number of distinct prime factors
 */
int mobius[N];
/**
 * @time  $O(n \log n)$ 
 */
void calc_mobius() {
    mobius[1] = 1;
    for (int i = 1; i < N; i++)
        for (int j = i + i; j < N; j += i)
            mobius[j] -= mobius[i];
}
```

### III. Irwin-Hall distribution

- [https://en.wikipedia.org/wiki/Irwin%E2%80%93Hall\\_distribution](https://en.wikipedia.org/wiki/Irwin%E2%80%93Hall_distribution)
- The **Irwin-Hall distribution** is the continuous probability distribution for the **sum** of **n** independent and identically distributed (i.i.d.)  **$U(0, 1)$** , a uniform distribution in the interval  $[0, 1]$ , random variables.
- (Elementary) **Probability** *may be* a good topic to learn for ICPC & (quant) interview! A good way to start would be by reading:
  - *A First Course in Probability*, Ross
  - *Introduction To Probability*, Bertsekas, et. al.



### III. Irwin-Hall distribution

PDF	$\frac{1}{(n-1)!} \sum_{k=0}^{\lfloor x \rfloor} (-1)^k \binom{n}{k} (x-k)^{n-1}$
CDF	$\frac{1}{n!} \sum_{k=0}^{\lfloor x \rfloor} (-1)^k \binom{n}{k} (x-k)^n$

### III. Irwin-Hall distribution

<b>Mean</b>	$\frac{n}{2}$
<b>Median</b>	$\frac{n}{2}$
<b>Mode</b>	$\begin{cases} \text{any value in } [0, 1] & \text{for } n = 1 \\ \frac{n}{2} & \text{otherwise} \end{cases}$
<b>Variance</b>	$\frac{n}{12}$

### III. Irwin-Hall distribution

MGF	$\left(\frac{e^t - 1}{t}\right)^n$
CF	$\left(\frac{e^{it} - 1}{it}\right)^n$

### III. Irwin-Hall distribution

- You *do not need to* memorize any of these (or in general, for any distribution, PDF/CDF, mean/median/mode/variance, and MGF/CF).
- **BUT**, make sure to have them in **your team notebook**, at the very least, just in case!

## IV. Where to go from here? (for ICPC)

- **Selection test** (locals in UCF!)
  - Make it to the team, to represent UCF in the regionals
- **Regionals**
  - Be the top few teams
- **North America Championship (NAC)s**
  - Make it to the world finals, with a goal of 'medal'-ing
- **World Final (WF)s**
  - Make it to the top 12, for a medal!
- **GOAL:** You should make it a goal to reach rating of **2600+** in CodeForces (roughly **top 300**)

## IV. Where to go from here? (for training)

- Train, train, train, BUT only go so much to **NOT** burnout. **IT IS REAL!**
- Each and every one of you can do it, from what I observed last few days!!
- Register for **Universal Cup**: ask Arup, if interested!
- **CSES**: <https://cses.fi/problemset/>
- **Kattis**: <https://open.kattis.com/> with its companion:  
<https://cpbook.net/methodstosolve?oj=kattis&topic=all&quality=all>
- **USACO Guide**: <https://usaco.guide/> (especially Platinum and Advanced)
- **CP Algorithm**: <https://cp-algorithms.com/>
  - String Processing; Graphs; Linear Algebra; Data Structures; ...

## IV. Discord Servers: Please Join Us/Me!

- You are the most enthusiastic, driven group of students I have ever interacted with!!!
- You will be able to **continue** your **enthusiasm** through this group!
- So, please join the following discord servers, if you have not already!!!

[ICPC CodeForces Zealots] <https://discord.gg/7bvMnMyF6G>

## IV. Practice makes **PERFECT!**

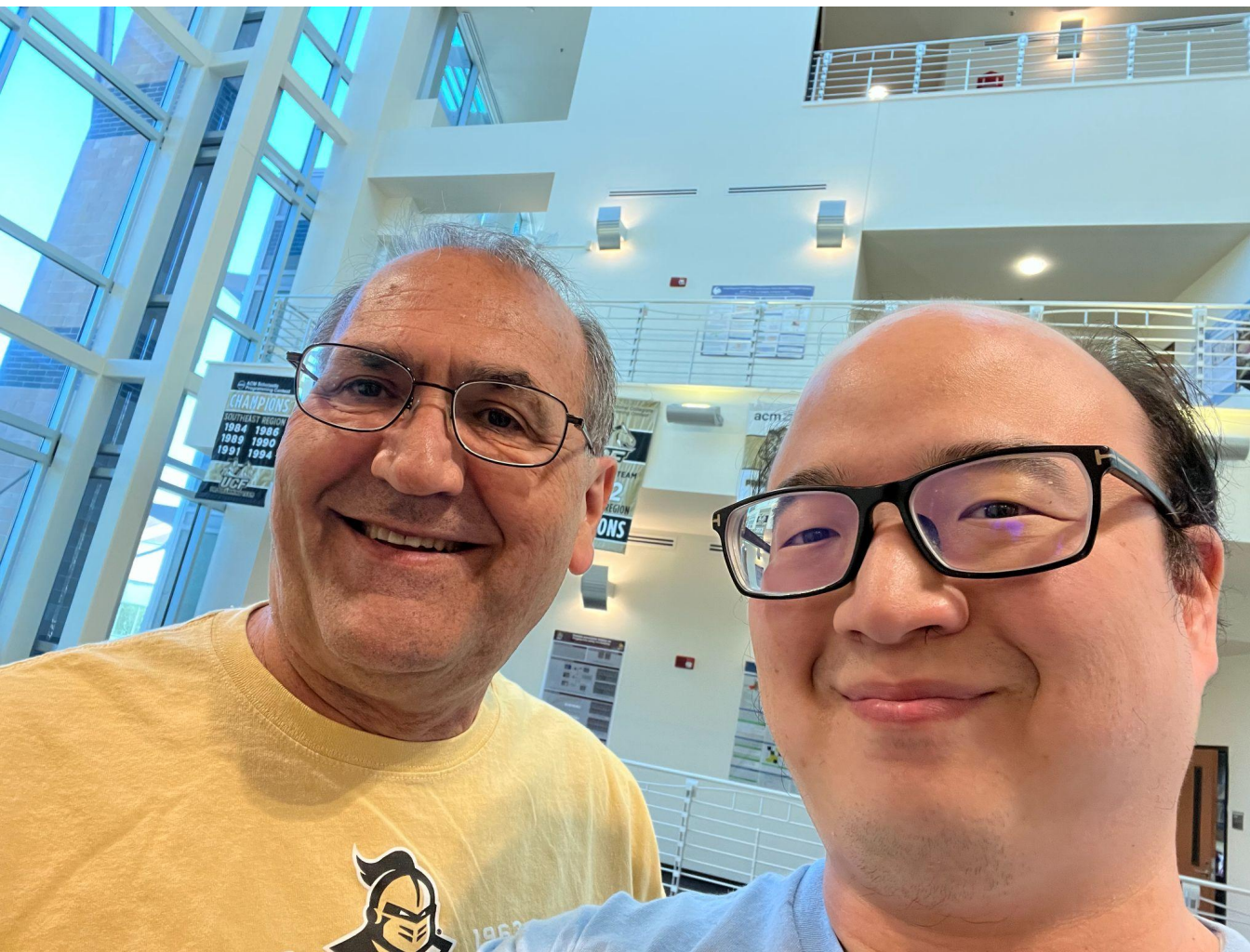
- Do as **many practice contests** as you can!
  - **Live Contests**
    - CodeForces: Division 1-4
    - AtCoder: Beginner; Regular; Grand;
    - LeetCode: Weekly/Biweekly
  - **ICPC North America Practice Contests** on:
    - **Sundays** from 1pm ET to 6pm ET
  - **Zealot Problem Sets**
    - **Everyday** (24 hours 7 days a week)!



## IV. A Terse Guide on ICPC Contest Strategies

- Please take a look at:
  - A [Terse Guide](#) on ICPC Contest Strategies for Columbia team.
  - In addition, we have [Google Drive](#) to Terse Guides, of course!
- These documents will be frequently expanded upon later.
- If you have any questions, please reach out to [yongwhan@yongwhan.io](mailto:yongwhan@yongwhan.io)!

# Pictures



**THANK YOU!!!**  
**Ali Orooji**



**THANK YOU!!!**  
**Ali Orooji**  
**Arup Guha**





**THANK YOU!!!**  
**E.v.e.r.y.o.n.e.!**

# THANK YOU

