Introduction

Dr. Bruce Nan

Email: xiaomingnan@gmail.com

Who am I

Dr. Bruce Nan

PhD in Electrical and Computer Engineering

10+ years in teaching Computer Competition

Teach Computer Contest level 2, 3, 4, 5, 6 classes

100+ students each year

Email: xiaomingnan@gmail.com

Computer Contest

- Competitive programming
  - A mind sport
  - Write programs to solve problems within given time
  - Not just coding (logical, math, algorithm, and coding)
  - Online judge
  - Recognized by top universities, software and internet companies

Who should take CC-3 class

- Know at least one programming language, like C, C++, Java, Python, etc.
- Know how to use standard input/output
- Know how to use if-else, loops
- Know how to use array, string, list
- Target at CCC 2020 Senior Contest

Class Evaluation

- Lectures: 40 %
- Homework: 40 %
  - HW available from Olympiads School website http://www.olympiads.ca/Homework.php
  - 6+ questions each time.
  - Solutions provided in next class
- Quizzes: 20 %

What we will learn in CC-3?

- Basic Data Structure
  - List / Set / Map
  - Stack / Queue / Deque
- Graph Algorithm
  - Adjacency Matrix, Adjacency Lists
  - BFS/DFS
  - Topological sorting
  - Minimum Spanning Tree: Prim algorithm, Kruskal algorithm
  - Disjoint Set Data Structure
  - Shortest path algorithm: Dijkstra, Floyd-Warshall

What we will learn in CC-3 (cont.)?

- Dynamic Programming
  - knapsack problem
  - LIS/LCS
  - Interval DP
  - Tree DP
  - Bitwise operations
  - DP with bitmask

Computer Contest for School Students

- CCC (Canadian Computing Competition)
  - Junior level
  - Senior level
- CCO (Canadian Computing Olympiad)
  - Invitation based
  - Top 25 (around) senior contestants from CCC senior
- IOI (International Olympiad in Informatics)
  - Top 4 contestants from CCO
  - International topmost computer competition

What is CCC?

- The Canadian Computing Competition (CCC) aims to benefit primary and secondary school students with an interest in programming.
- Junior Level – inspire students' interests in Computer Science
- Senior Level – selective contest, much harder than junior

Competition Contents

- CCC Contents
  - CCC consists of two distinct papers: the Junior Division paper and the Senior Division paper.
  - Each paper consists of 5 questions.
  - The range of difficulty increases from the first question to the last question on each paper.

Junior Division Paper

Questions 1 and 2	Straightforward (e.g. basic loops and conditions)
Questions 3 and 4	More challenging (e.g. some combination of loops, conditions and counting)
Questions 5	Some advanced material (e.g. recursion, efficient sorting and algorithms)

Competition Contents

Senior Division Paper

Questions 1 and 2	Basic algorithms (e.g., sorting, searching)
Questions 3 and 4	More advanced algorithms (e.g., careful counting, some mathematical reasoning)
Question 5	International Olympiad of Information (IOI) level question

- The Competition in each Division is marked out of a total of 75. Prizes for Junior entries are limited to certificates and medals. Prizes for Senior entries include certificates and invitations to Stage 2.

Why computer competition

- Good logic thinking
- When applying for some departments in U Waterloo, you may need to provide CCC results
- Also recognized by other Canadian Universities, like U of T
- IOI medals: Waterloo Olympiad Scholarship
- CCO medals = Waterloo offer + scholarship
- Cash prize & one week free camp at U Waterloo
- Join University ACM team
- Intern/job opportunity in famous IT company
  - Graduated students now worked in Google, Microsoft, Facebook, etc.

Language

- For CCC, competitors are allowed to use virtually any programming language which is supported at their school.

- For CCO, competitors must use C/C++ or JAVA Competitors in both stages may use more than one language during the competition.

Competition format

- CCC Online Grader
  - http://www.cemc.uwaterloo.ca/contests/computing.html
  - All students must use the Online Grader
  - Registration and use of the Online Grader is free at any time, regardless of any CCC registrations
- Junior and Senior problems both provided
- Can submit multiple times for each question
- Pick the highest mark of each question as final mark

IS CCC hard?

- YES
- If didn't take any training before, it's impossible to solve 4 senior questions in 3 hours.
- Even if junior questions, not easy to get perfect

CCC 2019 Averages

Problem	All Contestants	Non-Zero Scores	Problem	All Contestants	Non-Zero Scores
Junior 1	13.92	14.94	Senior 1	13.47	14.91
Junior 2	10.70	14.96	Senior 2	6.71	10.16
Junior 3	5.82	14.70	Senior 3	1.43	6.42
Junior 4	8.35	14.83	Senior 4	0.13	4.82
Junior 5	0.20	10.66	Senior 5	0.06	6.87

Bruce Students' Achievements

- 2019, **19 students (26 total)** invited to CCO , **5 gold**, 7 silver, and 7 bronze
- 2018, **3 students** joined Canadian IOI team (only 4 in Canada)**.**
- 2018, **16 students (22 total)** invited to CCO , **3 gold**, 5 silver, and 8 bronze
- 2018, **3 students** joined Canadian IOI team (only 4 in Canada)**, 1 gold and 2 silver.**
- 2017, **21 students (29 total)** invited to CCO, **3 gold**, 4 silver, and 12 bronze
- 2017, **3 students** joined Canadian IOI team (only 4 in Canada), **2 gold medals.**
- 2016, **12 students** invited to CCO (only 25 invitations in total), **2 gold, 4 silver, 6 bronze medals**
- 2016, **2 students** joined Canadian IOI team (only 4 in Canada), **1 gold medals, 1 bronze medals.**
- 2015, 5 students invited to CCO, **2 gold, 2 silver, and 1 bronze medals**
- 2015, 2 students joined Canadian IOI team (only 4 in Canada).
- 2014, 4 students invited to CCO, **2 gold and 2 bronze medals**
- 2014, 2 students joined IOI team (only 4 in Canada)
- 2013, 4 students invited to CCO and **2 silver and 2 bronze medals**

CCO 2019 Invitees

Name/Nom		School/École	Location/Endroit
CHAU	BRIAN	Woburn C.I	Scarborough,ON
CHEN	GEORGE	Marc Garneau C.I.	North York,ON
DONG	ANDREW	Centennial C. and V.I.	Guelph,ON
GUO	THOMAS	Phillips Exeter Academy	Exeter,NH
HALIM	HOWARD	University of Toronto Schools	Toronto,ON
IMANIVALA	ALIPASHA	UMC H.S.	Toronto,ON
JIANG	MAX	Lisgar C.I.	Ottawa,ON
KIM	JUHO	York Mills C.I.	North York,ON
LAN	SUNNY	Richmond Hill H.S.	Richmond Hill,ON
LI	WILLIAM	University of Toronto Schools	Toronto,ON
LI	MICHAEL	Marc Garneau C.I.	North York,ON
LI	RUDY	Earl Haig S.S.	North York,ON
LIAO	ALEXANDER	Waterloo C.I.	Waterloo,ON
LUO	ROYI	Richmond Hill H.S.	Richmond Hill,ON
PEI	ALLEN	University of Toronto Schools	Toronto,ON
PUN	AVA	Marc Garneau C.I.	North York,ON
QIN	BILL	Phillips Academy	Andover,MA
RONG	VICTOR	Marc Garneau C.I.	North York,ON
TANG	DAVID	University of Toronto Schools	Toronto,ON
UNG	STEVEN	Stephen Lewis S.S.	Thornhill,ON
WAN	KEVIN	Marc Garneau C.I.	North York,ON
WANG	JUNYI	William Lyon Mackenzie C.I.	North York,ON
WANG	SEAN	Point Grey S.S.	Vancouver,BC
XU	ALEX TIANYI	White Oaks S.S.	Oakville,ON
YI	RICHARD	William Lyon Mackenzie C.I.	North York,ON
ZHANG	EVAN	William Lyon Mackenzie C.I.	North York,ON
ZHOU	ZIXIANG	London Central S.S.	London,ON

Highlighted students are Bruce's students.

IOI Winners

Yikuan Li
ID: **FataleEagle**
IOI gold 2016

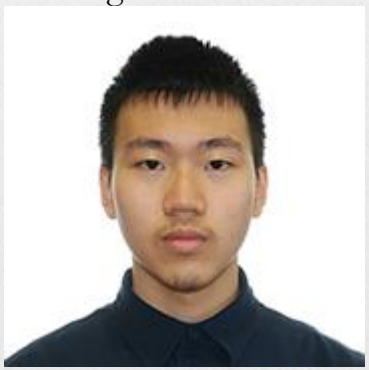
Jason Yuen
ID: **d**
IOI gold 2017

Brian Chau
ID: **imaxblue**
IOI gold 2017

Joey Yu
ID: **kobotor**
IOI gold 2018

Yixiao Zhang
ID: **Kuroba**
IOI bronze 2015

Jeffery Xiao
ID: **jeffreyxiao**
IOI bronze 2016



Victor Rong
ID: **r3mark**
IOI Silver 2018

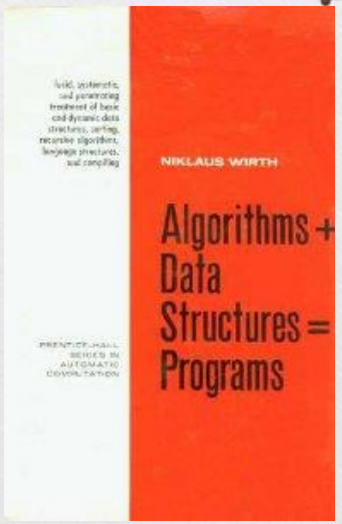
Ava Pun
ID: **AvaLovelace**
IOI Silver 2018

How to prepare

- Learn classical data structures and algorithms
- Practice questions
- Take online, regional, national and global contests

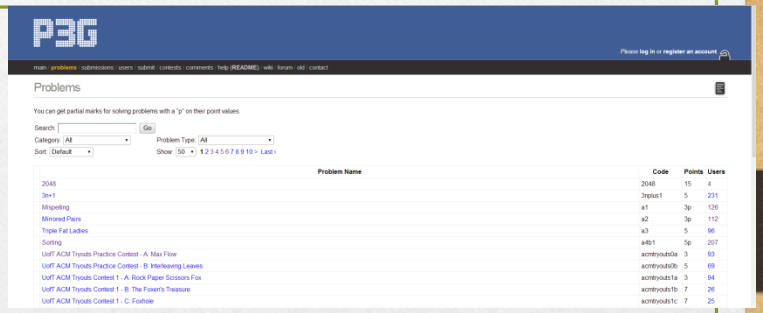
Is It just programming

- Absolutely NO
- Algorithms + Data structure = Programs
- LOGIC THINKING is more important
- CODING is just a tool



Online Judge

- DMOJ
  https://dmoj.ca/
- PEG
  http://wcipeg.com/problems
- Why use online judge?
  - Time limit
  - Memory limit
  - Check multiple test cases
  - Easy to track your work



How to use online judge?

- Register an account (if you don't have one)
- Join Olympiads School organization on DMOJ https://dmoj.ca/organization/31-olympiads-school
- Find a problem
- Write your program
- Submit your solution
- Check results

Submit Your Account

- Submit your account to me, so that I can check if you solved the HW questions or not

Entry Test

- https://dmoj.ca/contest/olylvl3entry191
- Access Code: summerschool

Thank You