Course Overview: Computer Contest Level 4 Class

WHO will teach Level-4 class?

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8+ years computer contest teaching experience
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WHO should take Level-4 class?

- Target at high mark in Canadian Computing Competition (CCC) **Senior** Division
- Know at least one programming language, like C/C++, Java, Python, etc.
- Participate CCC Junior or Senior before

WHAT will we learn in Level-4 class?

- Advanced data structure
  - Monotonic deque
  - Monotonic stack
  - 2D difference array
  - 2D prefix sum array
  - Binary indexed tree / Fenwick tree
  - Binary search tree
  - Treap
  - Splay tree
  - Segment tree (recursive and non-recursive)
  - Disjoint set
  - Binary heap / Priority queue
- Algorithms:
  - Advanced dynamic programming
  - Tree DP
  - Coordinate compression
  - Lowest Common Ancestor (LCA)
  - Range Max/Min Query (RMQ)
  - Line sweep algorithm
  - Advanced Graph algorithms
  - Graph algorithm: Tarjan algorithm
  - Graph algorithm: Optimized Dijkstra
  - Tree algorithm: Tree's diameter, radius and center
  - Tree algorithm: Heavy-light decomposition
  - Tree algorithm: Using difference array on a tree
  - Tree algorithm: Virtual tree
  - Divide and Conquer
  - Divide and Conquer on a tree
  - CDQ Divide and Conquer
  - Number theory: Miller-Rabin primality test
  - Number theory: Extended Euclidean algorithm
  - Computation geometry: Segment, Circle, Triangle
  - Computation geometry: Convex hull

HOW to evaluate in Level-4 class?

- Lecture: 50% (Student needs to attend each lecture)
- Homework: 30% (4-6 questions each time)
- Quiz: 20% (Two quizzes)
- Total: 100%

* Homework and quiz solutions provided on next class

WHAT will we practice in Level-4 class?

- Past CCC senior questions (S1 – S5) and partial CCO questions
- Select problems from local contest

WHAT I need to take Level-4 class?

- A laptop computer
- Interests in programming

F. A. Q.

What is CCC?

CCC is Canadian Computing Competition, held by University of Waterloo. It aims to benefit secondary school students with an interest in programming. CCC has junior and senior divisions.

What is CCO?

CCO is Canadian Computing Olympiad, topmost Canadian programming contest. It is an invitation based contest. Only **TOP 20** senior contestants all over Canada will be invited to participate CCO.

What is IOI?

IOI is International Olympiad in Informatics, topmost International programming contest. Each national team has 4 members to represent their country in the competition.

Why take computer competition?

- Improve logic thinking
- When applying for University of Waterloo CS, CE, SE, need to provide past CCC results
- More chances to get scholarship
    - IOI medals: Waterloo Olympiad Scholarship (CAD 40K/year)
    - CCO medals = Waterloo offer + scholarship
- More chances to join U Waterloo ACM team
- More intern/job opportunities in famous IT company, like Google, Facebook, Microsoft

What programming language can I use in CCC?

In CCC, students can use any programming language to write solution.

Who will mark my solution? Is there any partial mark?

Students' solution is marked by CCC online grader. There are several test cases. If the submission output correct answer for one case, it will get the corresponding points.

Students past achievement

- 2020, 3 students joined Canadian IOI team (only 4 in Canada).
- 2020, 18 students (24 total) invited to CCO, 4 gold, 8 silver, and 6 bronze.
- 2019, 3 students joined Canadian IOI team (only 4 in Canada).
- 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.