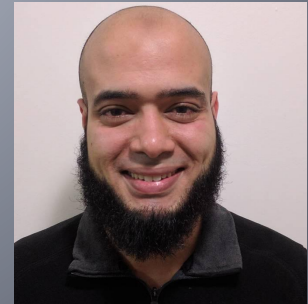P THINK FAST S

Competitive Programming

From Problem 2 Solution in O(1)

ACM ICPC Training
The Contest - 3 - Trends

Mostafa Saad Ibrahim
PhD Student @ Simon Fraser University

A Contest Trend

- Every contest has a style (nature or theme)
  - Almost close theme yearly
  - At some point, the theme might change to a new one
- One might perform pretty good in one trend, but perform worse in another
- Understanding the contest trend may help you perform better
- Let's first focus on the chief judge, the contest maestro

The chief judge

- Every contest has a chief judge
  - S/He is the main responsible for the contest **quality**
  - The chief has in his mind thoughts about the contest **style**
  - He makes a "**Call for Contribution**", asking for help
  - Contributors mainly **submit** problems (**problem setters**)
  - The bigger the problems pool, the better chance for a good and interesting problem set (**novel** ideas)
  - The chief needs help in **reviewing & testing** the problems
  - In the contest day, some of them play the **judge** role
  - This whole team is on the **enemy side** vs the contestants

The problem!

- Problem text
  - Some people like the text to be (very) short and clear. They believe the challenge should be in **getting the idea not** struggling with the text.
  - Some people keep putting **dirty tricks** in the problem text, causing teams to get several WAs before AC and exhausting them. It might be some written **info** in the body of a long text (those who skim text drop it). Sometimes weird printing for spaces and blank lines requirements (Ooh UVA problems). Etc.
  - Typically authors are not native English speakers. From time to time, there are unintended unclear text.

The problem!

- ## Algorithmic Category (See)
  - Basic & frequently appear categories (DP, BFS..)
  - Basic & !frequently appear categories (BellmanFord..)
  - Advanced Categories (Segment Tree, BBST)
  - Rare (BellmanFord constraints, VoronoiDiagram)
  - Remember the contest trend. What is common in a trend might be rare in another. Geometry is common in WF, but rare in our national/regional
- ## Problem Solution length
  - Length: 0.5 k bytes…..1-2k bytes …..4-6k bytes

The problem!

- Algorithmic Category vs the level
  - Let **Binary index tree** be a senior topic (it is not hard topic, but you study the basic/common algorithms and master them first, before studying them)
  - Should it appear on scale 4/10 so most people don't solve and senior teams get it in 10 min? Or make its level 7.5/10 so only seniors tackle it (they know more / more skilled)
- Number of contest problems
  - Should it be 10 problems? 12? 14?
  - What are the expected # of problems to be solved?

The problem!

- Problem idea
  - Sometimes an idea has much similarity/style with old problem(s). Once you see it, you get it.
  - Sometimes the problem is composed of several medium problems. This is its main difficulty.
  - Sometimes, the hardness comes from the needed amounts of analysis and observations..or from proving correctness / complexity.
  - Sometimes, the idea is easy, but with half dozen of tricky cases and scenarios (several WAs)
  - ...

Finalizing a problem

- Finalizing the problem is time consuming
  - Test data: It is challenging to cover all test cases. The balance of the test data cases (small vs large cases)
  - Determine what complexities should be ok (nlogn, nlognlong should pass, O(n^2) shouldn't]
  - Writing solutions with different: Perspectives, testers and languages
  - Does a language has a clear advantage? E.g. big integers in java? One language is very slow relative to others?
  - What is the allowed processing time? 3 x our fastest solution?

The chief judge again

- The problems pool
  - At some point, the chief judge has a pool of several problems (after a lengthy process).
  - The chief has some perspective about each problem. E.g. it can be for problem G:
  - Medium length text, category: {BIT, DP, Optimizations}, level = 8.5/10, code length = 3k, team think it is novel (but no one knew its similarity to a SPOJ problem)
  - The Chief judge has in mind a trend to the contest.
  - S/He has to make a decision about what to include according to his vision & the available in the pool

The chief judge again

- Decisions might be:
  - 12 problems overall like last year / short & clear text
  - Scales: 1, 2, 3, 4, 5, 6, 6.5, 7, 7, 8, 8.5, 10
  - The hardest problem is decided to be not solvable at all. However, winner expected to solve 9-10 problems. If more stronger, they still have another hard problem to get
  - Categories of the first 5 problems are **basic and common** ones (ad hoc, greedy, binary search, dp, dijkstra).
  - 6th is tricky greedy (multiple WAs), 7th is hard impl, 8th is euler+weighted bipartite match, 9th is sweep line
  - The hardest 3 problems: 2D Segment Tree, Binary search+multiple DPs, tough FFT

Contest Trends again

- Some contests seems intentionally have a trend (that might change after few years).
- Contest trend might be coupled with a person. Same trend as long as the same chief. Once he is changed, the trend/style might chage
  - To what degree the new chief judge has his own thoughts?
  - The communication level between old & new chief?
  - Are people ok with the last years problem sets, or have complaints/suggestions for the contest trend?

ECPC/ACPC

- ECPC/ACPC
  - Both ECPC/ACPC are of close level (In past, ECPC was harder)
  - The problem levels may be around (2, 3, 4, 5, 6, 6, 6.5, 6.5, 7, 7, 7.5, 8) / 10
  - As an approximation of these levels in terms of CF:
  - D2-A (2), D2-B(3), D2-C(4-5), D2-D(5-6), D2-E(6-7.5), D1-D(7.5-8.5), D1-E(8.5-9.5)
  - E.g. a good team in Div2-C may solve 4-5 problems
  - E.g. a good team in Div2-D may solve 5-6 problems
  - E.g. a good team in Div2-E may solve 7-10 problems

Egyptian CPC (ECPC)

- **Not sure** about its trend
  - It depend on who is the chief judge.
  - Till 2007, Some problems where from the web, especially some hard problems
  - I was the chief judge for ECPC/JCPC 2011. I just did what I thought is a good style. Contest was hard (10 problems, top 7 guys solved: 6 4 4 4 4 4 3)

Egyptian CPC (ECPC)

- Chief judges
    - Ashraf Abdelbar 2000, 2003, 2004
    - Osama abdelhamed: 2005, 2006, 2007
    - Hamza Darwish: 2008, 2009
    - Mohamed El asmar: 2010
    - Mostafa Saad: 2011 (on SPOJ: PWORDS, MCLB, RDNWK, EGYPAR, ACHESS, SKEY, PROSCORE, MENMARS, FSEQ)
    - Ahmed Saad: 2012 (on SPOJ: EVENODD , SHES, STRSOCU, FATAWY)
    - Amr Samir: 2013, 2014
    - Medhat Elsoos: 2015 (editorial, c, d), 2016 (sols)
    - Old competitions are not available online

Arabian CPC (ACPC)

- ## 200X - 2007 trend
  - No idea about the problem setters / chief judges.
  - Wahab(Fegla) trainees criticized this trend. When they were chief judges/setters, they took a new direction.
  - Don't train on these ones. This trend is totally changed
- ## 2008-2011
  - Chief judges in order: Mohamed Taha, Khaled Hafez, Hamza Darwish,
  - Good quality contests, close theme

Arabian CPC (ACPC)

- [2012](#)-2014 trend: Chief Judge Ahmed Aly
  - Same person, and was same trend (liked by many)
- 2015-2016 trend: Chief Judge Islam Al-Arag
  - Same person, and was same trend
  - Ahmed and Islam contests are close. Maybe Islam has little higher quality in some years (e.g. in 2015).
- For tuning performance for ACPC, solve 2012-2016+.
  - If wanna more, solve 2008-2011, but not before that

ICPC Trend: Problem Levels

Year	# Problems	Top 5 solved	ACPC solved	Problems Levels (Auto+Manual / Subjective)
2007	10	8 7 6 6 6	< 3	6 6 6.5 7 7.5 7.5 7.5 7.5 8.5 9
2008	11	8 7 7 7 7	< 3	6.5 7 7 7 7 7.5 7.5 8 8.5 8.75 9
2009	10	9 9 8 8 7	3	6.5 7 7 7.5 7.75 8.5 8.5 8.5 8.5 8.5
2010	10	7 7 6 6 6	< 3	6.75 7 7 7 7.25 7.5 8 8.5 8.5 8.5
2011	11	8 8 7 7 7	3	6 6.75 7 7.5 8 8.5 8.5 8.5 8.5 8.5 8.5
2012	12	9 9 8 7 7	3	6 6 6.5 7 7 7.25 7.5 8 8.25 8.5 9 9.5
2013	11	10 9 8 8 8	3	6 6.5 6.5 7 7 7.5 7.5 8 8 8 8.5
2014	12	7 7 6 6 5	2	6 7 7 7.5 8 8 8.5 8.5 8.5 9 9
2015	13	**13** 11 11 10 10	5	6 6 6.5 6.75 7 7.25 7.5 8 8 8.5 8.5 9 9
2016	13	**11** 11 10 10 10	4	6 6 6 6.5 6.5 7 7 8 8.5 8.5 8.5 8.5
2017	12	10 10 10 10 10	4	**4 4 4.5** 6.75 7 7.25 7.5 8 8.25 9 9.5 9.5

ICPC Categories

- Categories
  - WF Finals focuses on a **small set** of algorithms
  - Most repetitive: Geometry (trigonometry, computational, sweep line, 3D), DP, Ad hok/bf/search, graph (shortest path, dfs/bfs, max-flow variants)
  - **Others**: Greedy, Simulation, Binary Search, Grid Compress, Probability, SCC, MST, numerical analysis, Gaussian for equations
  - This is on contrary to ECPC/**ACPC** where more algorithms may appear (Segment Tree, Binary Indexed Trees, Treaps, Suffix Arrays, KMP, Number Theory…) and some are very little (Geometry, Probability)

ICPC Trend: Our region

- Notes for our region performance
    - Since 2015, 2 extra problems intended to be easy-med
    - WF Finals problem levels **go up so fast** (7+ level)
    - Contest & problems cause much pressure on the teams. Typically strong teams do several weird bugs/mistakes
    - Many of our teams seem don't train hardly in WF period, don't solve as much as possible, don't do enough team contests to tune team performance to such a style
    - Typically other 1-2 problems can be solved in actual contest, but some contest factors goes against the teams
    - We need the individual level of trainees to be higher

How to recognize the trend

- Coach support in that is highly prefered
- Solve/check contests editorials
- For a problem in a single contest
  - Rate its text style … Rate problems ideas level
  - Spectrum of code lengths, the used categories
  - Any hard/senior knowledge at the easy level?
  - Try to create a picture on a single contest style
- Do consecutive contests follow same style?
- For world finals
  - Per editorials. Snapdragon solutions. Arup Guha solutions

Training sources

- Sources
  - Let your initial yearly training be generic
  - Train for all judges, e.g. UVA, SPOJ, CF, T, CodeChef..
  - Before contest, tune yourself on its trend
  - Your team contests on the available contests
  - Coach role is important to focus on what is related
- ICPC
  - ICPC problems somehow have special taste. Finding similar problems is not easy job. Tricks, observations and annoying impl is the natural theme for many problems
  - This is not the case at all for ECPC/ACPC

Acknowledgement

- For ECPC/ACPC, I was **insider**. I knew some details and parts of the big picture from inside. I am a friend of many guys who played important roles. I was contestant, trainer, coach, problem setter, judge and chief judge.
- For ICPC, I am **outsider**. So all what I could do are some thoughts on the problem sets

تم بحمد الله

علمكم الله ما ينفعكم

ونفعكم بما تعلمتم

وزادكم علماً