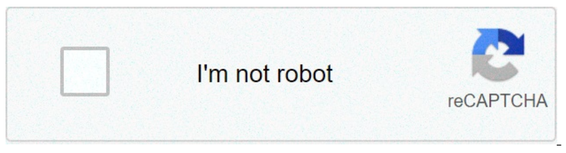

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Competitive programmer's handbook java

During the course, you'll learn everything needed to participate in real competitions — that's the main goal. Along the way you'll also gain useful skills for which competitive programmers are so highly valued by employers: ability to write efficient, reliable, and compact code, manage your time well when it's limited, apply basic algorithmic ideas to real problems, etc.We start from the very beginning by teaching you what competitions there are, what are their rules, what specifics problems have, how to read problem statements, how to organize your work, and what you should and shouldn't do. So it's fine if you've never taken part in programming competitions before. We'll focus on skills essential to competitive programming: inventing solutions and proving their correctness, estimating their running time, testing and debugging programs, how to benefit from structuring code. We'll also cover basic algorithmic ideas: brute force search, dynamic programming, greedy algorithms, segment trees. On competitions, there are a lot of specific pitfalls, perilous to beginners — but that's not to worry, as we'll go through the most common of them: integer overflow and issues with fractional numbers, troubles of particular programming languages, how to get unstuck in general. And, you'll hone all these skills by solving practice problems, which are just like problems on real competitions. You could use any of the following programming languages: C, C++, C#, Haskell, Java, JavaScript, Python 2, Python 3, Ruby, Rust, Scala. We assume that you already know how to write simplest programs in one of these. Antti Laaksonen: Guide to Competitive Programming: Learning and Improving Algorithms Through Contests PDF of the book is available from Springer Link from Purdue IP addresses. A free earlier version of the book titled "Competitive Programmer's Handbook" Author's Site Johan Sannemo: Principles of Algorithmic Problem Solving Steven S Skiena and Miguel A. Revilla: Programming Challenges: The Programming Contest Training Manual PDF of the book is available from Springer Link from Purdue IP addresses. Steven Halim and Felix Halim: Competitive Programming Problems on UVa and Kattis associated with the book: Methods to Solve Other Competitive Programming Courses UIUC: CS 491: Advanced Competitive Programming Reykjavik University: T-414-ÁFLV: A Competitive Programming Course Stanford: CS 97SI: Introduction to Programming Contests CMU: 15-295: Competitive Programming and Problem Solving UT Austin: CS104c: Competitive Programming Stonybrook: CSE 300X - Programming Challenges National University of Singapore: CS3233: Competitive Programming ITMO University (course through EDX): How to Win Coding Competitions: Secrets of Champions Other Online Algorithm Courses Robert Sedgewick and Kevin Wayne (Princeton University): Algorithms, Part I and Algorithms, Part II on Coursera. These courses are free. Assignments are in Java. Tim Roughgarden (Stanford University): Algorithms Specialization on Coursera Assignments in any language. 4 courses. (1) Divide and Conquer, Sorting and Searching, and Randomized Algorithms, (2) Graph Search, Shortest Paths, and Data Structures, (3) Greedy Algorithms, Minimum Spanning Trees, and Dynamic Programming, (4)Shortest Paths Revisited, NP-Complete Problems and What To Do About Them. Daniel M Kane, Neil Rhodes, Pavel Pevzner, Michael Levin, Alexander S. Kulikov (UC San Diego): Data Structures and Algorithms Specialization on Coursera. This has six courses. (1) Algorithmic Toolbox, (2) Data Structures, (3) Algorithms on Graphs, (4) Algorithms on Strings, (5) Advanced Algorithms and Complexity, (6) Genome Assembly Programming Challenge Web Sites LeetCode Codeforces AtCoder Google Code Jam Google Kick Start USACO Croatian Open Competition in Informatics ICPC Regionals with Problem Sets, Scoreboards, and Solutions. Problem submissions for NWERC, NEERC, CERC, and SWERC can be done at ICPC Live Archive A curated list of awesome Competitive Programming, Algorithm and Data Structure resources. This list is aimed to provide a complete reference and guidance for everyone. No matter who you are, I hope you'll find this list helpful. What is competitive programming? - Quora Contributing Please kindly follow CONTRIBUTING.md to get started. You can also contribute by sharing! Share the list with your classmates, your friends and everyone :) By connecting more people to information, You, are doing not me, but everyone a HUGE favor! I really hope that more people can benefit from this list :) Table of Contents Awesome Reference Materials Algorithms and Data Structures Awesome websites to lookup and learn algorithms and data structures. ☆ Name Description ★★★ topcoder Data Science Tutorials A list of tutorials written by respected topcoder members. Many top programmers started learning data sciences from here. ★★★ E-Maxx (Russian), (English) A tutorial website widely used and referenced in the Russian-speaking competitive programming community. Only a small fraction of the original site is translated into English, but Google Translate would work okay. ★★☆ Algorithms - GeeksforGeeks A website with a large archive of nicely written articles on different topics. It is a great complimentary resource for algorithm courses. ★★☆ PEGWiki A website with amazing in-depth wiki-like writeups on many topics. It's far better than those on Wikipedia in my opinion. ★★☆ Notes - HackerEarth A great crowdsourcing platform for tutorials. Also visit Code Monk. ★★☆ USA Computing Olympiad (USACO) Contains several training pages on its website which are designed to develop one's skills in programming solutions to difficult and varied algorithmic problems at one's own pace. ★☆☆ OLYMPIADS IN INFORMATICS An international journal focused on the research and practice of professionals who are working in the field of teaching and learning informatics to talented student. ★☆☆ algolist (Russian) A Russian website devoted to algorithms of all sorts. Some topics listed on this website seems pretty interesting. ★★☆ 演算法筆記 (Algorithm Notes) (Chinese) One of the most popular tutorial websites among the Taiwanese competitive programming community. The maintainer for this website spends immense efforts on researching algorithms. ★★☆ 国家集训队论文 1999-2015 (Papers from Chinese IOI training camps) (Chinese) Papers from the Chinese IOI training camps. It's interesting for the fact that one can tell different regions emphasize different things. Syllabuses Find out what topics you need to learn. ☆ Name Description ★★★ IOI Syllabus A detailed syllabus on which IOI contestants will be tested. This is still somewhat relevant to ACM-ICPC. ★★☆ Programming Camp Syllabus A list of important topics in competitive programming with exercise problems. List of Lists Awesome curated lists classified by topics. Implementations / Notebooks Algorithm / Data structure implementations. It is advised that you write yours first before looking at others'. ☆ Name Description ★★★ CodeLibrary, by Andrey Naumenko (indy256) CodeLibrary contains a large collection of implementations for algorithms and data structures in Java and C++. You may also visit his GitHub Repository. ★★★ spaghetti-source/algorithm, by Takanori MAEHARA (@tmaehara) High-quality implementations of many hard algorithms and data structures. ★★☆ jaehyunp/stanfordacm Stanford's team notebook is well maintained and the codes within are of high-quality. ★★☆ ngthanhtrung23/ACM_Notebook_new, by team RR Watameda (I_love_Hoang_Yen, flashmt, nguyenhungtam) from National University of Singapore RR Watameda represented National University of Singapore for the 2016 ACM-ICPC World Finals. The items in this notebook are pretty standard and well-organized. ★★☆ bobogei81123/bcw_codebook, by team bcw0x1bd2 (darkhh, bobogei81123, step5) from National Taiwan University bcw0x1bd2 represented National Taiwan University for the 2016 ACM-ICPC World Finals. This notebook contains robust implementations for advanced data structures and algorithms. ★☆☆ foreverbell/acm-icpc-cheat-sheet, by foreverbell (foreverbell) A notebook with some advanced data structures and algorithms including some from the China informatics scene. ★☆☆ igor's code archive, by Igor Naverniouk (Abednego) A good notebook by Igor Naverniouk who is currently a software engineer at Google and part of the Google Code Jam team. Language Specifics Languages and other miscellaneous knowledge. C/C++ Java Miscellaneous Tools Awesome tools that will make your life easier. IDEs ☆ Name Platform Description ★★★ Vim CLI / Cross-Platform Vim is one of the most popular text editors among advanced programmers. It allows text-editing to be done very efficiently with solely keystrokes. Vim is also highly configurable, extensible and integrates with shells (command lines) really well. The only setback about Vim is that it has a high learning curve for beginners. ★★★ Emacs CLI / Cross-Platform Emacs is another popular text editor (or development environment to be more precise). The debate on "Vim vs. Emacs" is constantly brought up due to their popularity. Basically Emacs is more than just a text editor. It has plugins like file managers, web browsers, mail clients and news clients that allows users to performs these tasks directly inside Emacs. Emacs is "heavier" because of this, but it arguably has a relatively easier learning curve for beginners. ★★★ Far Manager Hybrid / Windows Far Manager is the most widely-used editor in the RU/CIS competitive programming community. It's actually a file manager in its bare bones, but you can install FarColorer - a syntax highlighter plugin to program on it. Properly configured, Far Manager allows you to navigate between files very efficiently while writing your codes. ★★★ Code::Blocks GUI / Cross-Platform Code::Blocks is the go-to IDE for C/C++. It's a full-fledged, versatile IDE with numerous great features. Code::Blocks is usually provided along with Vim in programming contests. ★★★ IntelliJ IDEA GUI / Cross-Platform IntelliJ IDEA is certainly one of the best IDEs for Java. It's used by most competitive programmers who use Java as their main language. Be sure to check out CHelper, a very handy plugin written for programming contests. ★★☆ Sublime Text GUI / Cross-Platform Sublime Text is an extraordinary text editor. Packed with powerful and innovative features like Multiple Carets, Minimaps and Command Palletes, it attracts a strong and engaging community. Sublime Text is highly extensible, so be sure to have Package Control installed and explore perhaps one of the largest catalogue of plugins! ★★☆ Eclipse GUI / Cross-Platform Eclipse is another good IDE for Java. It's an okay alternative to Intellij IDEA (A tad inferior to IDEA by today's standards). Sometimes contests only provide Eclipse for some reason, so this might be a good incentive to try and use Eclipse. ★★☆ CLion GUI / Cross-Platform CLion, produced by JetBrains - the same company who made Intellij IDEA, is a powerful IDE for C++. Free educational licenses are available OR you can try out their EAP (Early Access Program) which is still free as of Aug, 2016. You may want to turn off its code inspection feature as it will cause quite a bit of lag. ★☆☆ Other IDEs Mixed Visual Studio is the IDE to use in case you want to code in C#, but beware that it will be a 7GB installation. ... Both Atom and Visual Studio Code are built with Electron (written in JavaScript) and therefore somewhat resource-hogging. ... CodeLite is a newly rising IDE. Beware that the load-up and project-creation times can be extraordinary. Personal use ☆ Name Description ★★★ VisuAlgo A website featuring a large collection of visualization tools for algorithms and data structures. ★★★ General Practice Helpers: ... CHelper (IntelliJ IDEA) (manual) ... caide (Visual Studio, CodeLite) ... JHelper (AppCode, CLion) Great tools that parse contests, inline library codes and provide testing frameworks. They save you from spending your precious time on switching windows and copy-pasting back and forth. ★★☆ Codeforces Parsers: ... Codeforces Parser ... GoCF ... cfparser (emacs) These tools parse Codeforces contest problems and help run sample tests. ★★★ The On-Line Encyclopedia of Integer Sequences (OEIS) A stunning encyclopedia with a database of countless integer sequences. It also features a powerful search engine. Sometimes a seemingly difficult combinatorics problem could be equivalent to a simple or studied integer sequence. ★★☆ Syntax Highlighters: ... tohtml.com ... markup.su ... hilite.me Very handy for creating slides or team notebooks with pretty, formatted code snippets. Just copy the highlighted code snippets and paste them in your favorite WYSIWYG (What-You-See-Is-What-You-Get) editor! ★★☆ Code Sharing: ... Ideone.com ... Pastebin.com ... Ubuntu Pastebin These tools generate semi-permanent pages for code sharing. Very useful especially when you're trying to get someone else to look into your code. ★★☆ Ineffable A simple command-line grader for local grading. Contest Preparation ☆ Name Description ★★★ polygon polygon provides a platform and a rich set of tools for professional contest preparation. ... An example: Validators with testlib.h - Codeforces ★★☆ Graph Editor A fantastic tool to create and visualize graphs. ★★☆ tcframe A C++ framework for generating test cases of competitive programming problems. ★★★ Virtual Judge (vjudge) Virtual Judge (vjudge) allows users to create virtual contests with problems from notable problem archives. ★★☆ BNU Online Judge BNU Online Judge also allows users to create virtual contests. ★★☆ Kattis Kattis assists in contest preparation (E-mail them for assistance). Awesome Learning Materials Open Courses Consider beginning your competitive programming journey with these awesome courses! Open Courses for Algorithms and Data Structures ☆ Name Description ★★★ prakhar1989/awesome-courses#algorithms A fantastic list of open courses offered by notable institutions (MIT, Stanford, UC Berkeley ... etc.). ★★★ MIT SMA 5503: Introduction to Algorithms Lectured by Prof. Charles Leiserson (one of the coauthors of Introduction to Algorithms) and Prof. Erik Demaine (a brilliant professor who has made remarkable breakthroughs in data science), the course offers great materials, accompanied by intuitive and comprehensive analyses. Books A list of recommended books for competitive programming. ☆ Name Description ★★☆ Competitive Programming, by Steven and Felix Halim This book contains a collection of relevant data structures, algorithms, and programming tips. It's a well-received book. ... The first edition is free for download (pdf). ★★☆ Programming Challenges: The Programming Contest Training Manual, by Steven Skiena and Miguel Revilla This book includes more than 100 programming challenges, as well as the theory and key concepts necessary for approaching them. Problems are organized by topic, and supplemented by complete tutorial material. ★★★ Looking for a Challenge, written by a group of authors associated with the Polish Olympiads Most of the problems described in the book are really hard but they are explained in such a way that even beginners can understand. It appears to be out of stock (as of Aug, 2016), but you can reserve one on their official website. ★★☆ Computational Geometry: Algorithms and Applications, by Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars This is a well-written book which covers a broad range of computational geometry problems. ★☆☆ The Hitchhiker's Guide to the Programming Contests, by Nite Nimajneb This book is free for download (pdf). This book covers various topics relevant to competitive programming. ★★★ プログラミングコンテストチャレンジブック (Japanese), by 秋葉拓哉, 岩田陽一, 北川宜稔 An absolutely phenomenal book. The contents, organized in a very coherent manner, are nothing short of amazing. ... 培養與鍛鍊程式設計的邏輯腦：世界級程式設計大賽的知識、心得與解題分享 (Chinese Traditional) ★★☆ 算法竞赛入门经典 (Chinese), by 刘汝佳 The Art of Algorithms and Programming Contests (English), 打下好基礎：程式設計與演算法競賽入門經典 (Chinese Traditional) ★★☆ 算法竞赛入门经典——训练指南 (Chinese), by 刘汝佳, 陈锋 提升程式設計的解題思考力–國際演算法程式設計競賽訓練指南 (Chinese Traditional) ★★★ 算法艺术与信息学竞赛 (Chinese), by 刘汝佳, 黄亮 An old-time classic. It's old but the contents in this book are still considered to be very difficult by today's standards. Books for Algorithms ☆ Name Description ★★★ Introduction to Algorithms, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein Also known as CLRS (taken from name initials), this book is often referred to as the "bible" for algorithms and data structures. It's one of the most popular textbooks for university algorithm courses. This book covered various algorithms and data structures in great detail. The writing is more rigorous and can be difficult to some. ★★☆ Algorithm Design, by Jon Kleinberg and Éva Tardos This book revolves around techniques for designing algorithms. It's well-organized and written in a clear, understandable language. Each chapter is backed with practical examples and helpful exercises. The chapter on network flow is highly praised by lots. ... The lecture slides that accompany the textbook are available on its official website. ★★☆ The Algorithm Design Manual, by Steven S. Skiena The book is written in more readable text. Some find it comprehensive than other books. You can also find some good resources (including the author's own video lectures) on its official website. ★★★ Algorithms, by Robert Sedgewick and Kevin Wayne This book is neatly categorized, coupled with elaborate explanations and fantastic illustrations. It is used in some IOI training camps as a textbook. Books for Mathematics ☆ Name Description ★★☆ Discrete Mathematics and Its Applications, by Kenneth H. Rosen Discrete Mathematics is closely relevant to competitive programming. This book provides comprehensive materials on a wide range of topics including: Logics and Proofs, Sets, Functions, Sequences, Matrices, Number Theory, Recursion, Counting, Probablity, Graphs, Trees and Boolean Alegra to name but a few. ★★☆ Concrete Mathematics: A Foundation for Computer Science, by Ronald L. Graham, Donald E. Knuth, Oren Patashnik The book offers a deeper insight into Discrete Mathematics with more emphases on number-related topics. ★★☆ Linear Algebra and Its Applications, by David C. Lay, Steven R. Lay, Judi J. McDonald The book does a brilliant job at bridging the gap between a physical system (for scientists and engineers) and an abstract system (for mathematicians). ★★☆ Introduction to Probability, by Charles M. Grinstead, J. Laurie Snell This is a well-written introductory probabilities book. ... It's free for download (pdf) (released under GNU Free Documentation License). ★★☆ How to Solve It: A New Aspect of Mathematical Method, by G. Polya An old-time classic. In this book, the author provides a systematic way to solve problems creatively. Sites to Practice Good online judge systems / contest platforms to practice. ☆ Name Description ★★★ Codeforces Codeforces is one of, if not, the most popular contest platforms out there. Currently maintained by Saratov State University, it features regular contests and countless awesome original problems. Additionally, every contest provides immediate helpful tutorials (usually) written by the authors themselves. Codeforces also houses a strong and engaging community. All in all, one would indeed learn and improve tremendously here. ★★★ topcoder topcoder has been around since 2001. Rich in history, It's considered to be one of the most prestigious organizations when it comes to technology competitions. Hundreds of SRMs gave birth to an abundant problemset. Problems here are typically more challenging than others and topcoder therefore appeals to many elite programmers. The annual topcoder Open (TCO) is also a widely-discussed event. ★★★ Google Code Jam Google Code Jam is certainly one of the most highly-esteemed programming competitions. The competition consists of unique programming challenges which must be solved in a fixed amount of time. Competitors may use any programming language and development environment to obtain their solutions. ★★☆ CodeChef CodeChef is a non-profit educational initiative of Directi. It's a global competitive programming platform and has a large community of programmers that helps students and professionals test and improve their coding skills. Its objective is to provide a platform for practice, competition and improvement for both students and professional software developers. Apart from this, it aims to reach out to students while they are young and inculcate a culture of programming in India. ★★★ SPOJ The SPOJ platform is centered around an online judge system. It holds a staggering amount of problems prepared by its community of problem setters or taken from previous programming contests, some of which are great problems for practice (refer to the Problem classifiers section). SPOJ also allows advanced users to organize contests under their own rules. ★★☆ Timus Timus Online Judge is the largest Russian archive of programming problems with automatic judging system. Problems are mostly collected from contests held at the Ural Federal University, Ural Championships, Ural ACM ICPC Subregional Contests, and Petrozavodsk Training Camps. ★☆☆ HDU HDU is an online judge maintained by Hangzhou Dianzi University. It's home to many classic problems from the Chinese IOI scene. ★★★ AtCoder AtCoder is a new but phenomenal contest platform created by a team of highly-rated Japanese competitive programmers. ★★☆ Aizu Online Judge Aizu online judge is a contest platform and problem archive hosted by The University of Aizu. It has a lot of great problems from programming competitions in Japan. ★★☆ UVa An old-school problem archive / online judge with rich history. Thousands of problems, including many classic ones, are featured here. However, it is strongly advised that you practice with uHunt following its "Competitive Programming Exercise" section. ★★☆ HackerRank HackerRank is a company that focuses on competitive programming challenges for both consumers and businesses. HackerRank's programming challenges can be solved in a variety of programming languages and span multiple computer science domains. ★★☆ POJ POJ is an online judge with many great problems maintained by Peking University. Most Chinese competitive programmers began their journey here. ★★☆ Project Euler Project Euler features a stunning set of good math problems. It also hosts a forum where people can discuss. ★☆☆ Hackerearth HackerEarth is a startup technology company based in Bangalore, India that provides recruitment solutions. ★☆☆ Caribbean Online Judge COJ is hosted by University of Informatics Sciences (UCI, by its acronym in Spanish), located in Cuba. Feature ACM ICPC and Progresive constest styles, mostly from Caribbean and Latin American problem setters, also has problem classifier and contest calendar. ★★☆ CS Academy New in the competitive programming scene, CS Academy is a growing online judge that hosts competitions once every two weeks. It supports live chat, interactive lessons and an integrated online editor (that actually works). Problem Classifiers Sites classifying programming problems. Choose a category (eg. DP) of interest and practice problems on that topic. Contest Calendars Calendars for impending programming contests. (Never miss another contest!) Sites to ask Questions These are great sites to ask questions. Paste your codes at ideone, pastebin or other sites to avoid formatting issues. ☆ Name Description ★★★ Codeforces For quick answers, Codeforces is definitely the go-to place to ask about anything competition-related. ★★★ Competitive Programming - Quora You would typically get more elaborate answers on Quora, but you might not have your questions answered straightaway. ★★☆ Theoretical Computer Science Stack Exchange This place is generally for the academics, so don't ask questions about contest problems here. Community Meet the god-like competitive programmers! Learn helpful tips, tutorials and insights from these people :) Blogs Youtube and Livestreams Quora Visit Competitive Programming - Quora (Top 10 Most Viewed Writers). 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