CPSC 221: Basic Algorithms and Data Structures
Last Updated: September 19, 2008

Course Description

This course is an introduction to the design and analysis of basic data structures. It integrates topics in discrete mathematics and data structures, thereby providing a theoretical and practical foundation for many of our 3rd and 4th year computer science courses. The topics in this course are listed on the last page of this document.

Prerequisites   CPSC 211, and one of CPSC 121 or MATH 220.

MATH 101 (or equivalent) is a corequisite, meaning that you either need to have credit for MATH 101 (or equivalent) or you have to take it concurrently. The department will enforce these prerequisites and corequisites. Equivalent credit for older versions of these courses (or appropriate transfer credits) will likely be acceptable.

Instructor   William Evans (will@cs.ubc.ca), office: ICCS X841[1]

Please limit e-mail to questions of a personal/confidential nature (e.g., sickness). The lectures, tutorials/labs, and bulletin board (also known as "Discussions" or "Discussion Group" on WebCT) are the right places to ask general questions. The bulletin board is read by all students in our lecture section, plus the TA's, and the instructor; so, a lot of us can respond to your questions. Students are encouraged to ask questions, and to respond to other students' questions, as long as the questions don't ask for answers to homework (theory or programming assignments).

TAs   Landon Boyd (blandon@cs.ubc.ca) and Ashiqur KhudaBukhsh (ashiqur@cs.ubc.ca)

Plus there will be several markers assigned to this course.

Office Hours

Will Monday 13:00-14:00 & Thursday 09:00-10:00 in ICCS X841

Landon Wednesday 15:30-16:30 & Friday 10:00-11:00 in ICCS X150

Ashiqur Tuesday 14:30-15:30 in ICCS X150

Lab/Tutorial Times (and a few comments about the programming in this course)

Labs/tutorials start during the second week of the course (Sep. 9th and after). You must be registered in one of the following lab/tutorial sections. Please pay attention to the handin dates for the programming labs — these are based on your registered lab section.

Lab	Date & Time	Location	TA	TA Helper	size
L1A	Tue 11:00–13:00	ICCS X350	Ashique	TBA	26
L1C	Thu 15:30–17:30	ICCS X251	Landon	TBA	22
L1D	Thu 10:30–12:30	ICCS X251	Ashique	TBA	19

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[1]Note that "ICCS" stands for the regular CS dept.'s building, sometimes called "CICSR" or "ICICS" or "ICICS/CS".

Cpsc 221 Basic Algorithms And Data Structures

Jyoti Prakash Singh

Cpsc 221 Basic Algorithms And Data Structures:

    CIPS Magazine Canadian Information Processing Society,1971   **Data Structures & Algorithm Analysis in C++** Mark Allen Weiss,1999 In this text readers are able to look at specific problems and see how careful implementations can reduce the time constraint for large amounts of data from several years to less than a second Class templates are used to describe generic data structures and first class versions of vector and string classes are used Included is an appendix on a Standard Template Library STL This text is for readers who want to learn good programming and algorithm analysis skills simultaneously so that they can develop such programs with the maximum amount of efficiency Readers should have some knowledge of intermediate programming including topics as object based programming and recursion and some background in discrete math   *Algorithms and Data Structures* Jonathan Rigdon, Algorithms and Data Structures are fundamental concepts in computer science that play a crucial role in solving problems efficiently and managing data effectively Algorithms are step by step procedures or sets of rules used to solve computational problems They can range from simple tasks like sorting a list of numbers to complex computations like finding the shortest path in a graph or optimizing a schedule Data Structures on the other hand are ways of organizing and storing data in a computer so that it can be accessed and manipulated efficiently Examples of data structures include arrays linked lists trees graphs stacks and queues Understanding algorithms and data structures is essential for developing efficient software solutions and optimizing performance in various applications including software engineering data analysis artificial intelligence and web development By mastering these concepts programmers can write more efficient and scalable code that can handle large datasets and complex computations

    Data Structures And Algorithms Anil Sudhakar Kurhekar,2021-06-27 A computer program is a set of instructions arranged in systematic manner a to perform a specific task For this a computer program may need to take actions like store data retrieve data and perform computations on the data A data structure is a named location that can be used to store and organize data And an algorithm is a set of of steps to solve a particular problem Learning data structures and algorithms allow us to write efficient and optimized computer programs This Data Structures And Algorithms book will introduce you to learn different types of data structures and algorithms Implementations of some of the basic algorithms are presentedin different computer languages   *A Practical Introduction to Data Structures and Algorithm Analysis* Clifford A. Shaffer,2001 This practical text contains fairly traditional coverage of data structures with a clear and complete use of algorithm analysis and some emphasis on file processing techniques as relevant to modern programmers It fully integrates OO programming with these topics as part of the detailed presentation of OO programming itself Chapter topics include lists stacks and queues binary and general trees graphs file processing and external sorting searching indexing and limits to computation For programmers who need a good reference on data structures   **Data Structures and Algorithm Analysis in C** Mark Allen Weiss,1997 Mark Allen Weiss successful book provides a modern approach to algorithms and data structures using the C

programming language The book s conceptual presentation focuses on ADTs and the analysis of algorithms for efficiency with a particular concentration on performance and running time This edition contains a new chapter that examines advanced data structures such as red black trees top down splay trees treaps k d trees and pairing heaps among others All code examples now conform to ANSI C and coverage of the formal proofs underpinning several key data structures has been strengthened   Data Structures And Algorithms Using C Jyoti Prakash Singh, The book Data Structures and Algorithms Using C aims at helping students develop both programming and algorithm analysis skills simultaneously so that they can design programs with the maximum amount of efficiency The book uses C language since it allows basic data structures to be implemented in a variety of ways Data structure is a central course in the curriculum of all computer science programs This book follows the syllabus of Data Structures and Algorithms course being taught in B Tech BCA and MCA programs of all institutes under most universities   **Algorithms in C, Parts 1-4** Robert Sedgewick,1997-08-22 Robert Sedgewick has thoroughly rewritten and substantially expanded his popular work to provide current and comprehensive coverage of important algorithms and data structures Many new algorithms are presented and the explanations of each algorithm are much more detailed than in previous editions A new text design and detailed innovative figures with accompanying commentary greatly enhance the presentation The third edition retains the successful blend of theory and practice that has made Sedgewick s work an invaluable resource for more than 250 000 programmers This particular book Parts 1 4 represents the essential first half of Sedgewick s complete work It provides extensive coverage of fundamental data structures and algorithms for sorting searching and related applications The algorithms and data structures are expressed in concise implementations in C so that you can both appreciate their fundamental properties and test them on real applications Of course the substance of the book applies to programming in any language Highlights Expanded coverage of arrays linked lists strings trees and other basic data structures Greater emphasis on abstract data types ADTs than in previous editions Over 100 algorithms for sorting selection priority queue ADT implementations and symbol table ADT searching implementations New implementations of binomial queues multiway radix sorting Batcher s sorting networks randomized BSTs splay trees skip lists multiway tries and much more Increased quantitative information about the algorithms including extensive empirical studies and basic analytic studies giving you a basis for comparing them Over 1000 new exercises to help you learn the properties of algorithms Whether you are a student learning the algorithms for the first time or a professional interested in having up to date reference material you will find a wealth of useful information in this book   *DATA STRUCTURE AND ALGORITHMS. MADE EASY GUIDE* . Harry. H. Chaudhary.,2014-06-02 Essential Data Structures Skills Made Easy This book gives a good start and Complete introduction for data structures and algorithms for Beginner s While reading this book it is fun and easy to read it This book is best suitable for first time DSA readers Covers all fast track topics of DSA for all Computer Science students and Professionals Data Structures and Other Objects Using C or C takes a gentle

approach to the data structures course in C Providing an early text gives students a firm grasp of key concepts and allows those experienced in another language to adjust easily Flexible by design Finally a solid foundation in building and using abstract data types is also provided Using C this book develops the concepts and theory of data structures and algorithm analysis in a gradual step by step manner proceeding from concrete examples to abstract principles Standish covers a wide range of Both traditional and contemporary software engineering topics This is a handy guide of sorts for any computer science engineering Students Data Structures And Algorithms is a solution bank for various complex problems related to data structures and algorithms It can be used as a reference manual by Computer Science Engineering students this Book also covers all aspects of B TECH CS IT and BCA and MCA BSC IT Inside Chapters 1 Introduction 2 Array 3 Matrix 4 Sorting 5 Stack 6 Queue 7 Linked List 8 Tree 9 Graph 10 Hashing 11 Algorithms 12 Misc Topics 13 Problems   *Introduction to Algorithms & Data Structures 2* Bolakale Aremu,2023-06 Benefits of This Book Learning algorithms and data structures from this book will help you become a better programmer Algorithms and data structures will make you think more logically Furthermore they can help you design better systems for storing and processing data They also serve as a tool for optimization and problem solving As a result the concepts of algorithms and data structures are very valuable in any field For example you can use them when building a web app or writing software for other devices You can apply them to machine learning and data analytics which are two hot areas right now If you are a hacker algorithms and data structures in Python are also important for you everywhere Now whatever your preferred learning style I ve got you covered If you re a visual learner you ll love my clear diagrams and illustrations throughout this book If you re a practical learner you ll love my hands on lessons so that you can get practical with algorithms and data structures and learn in a hands on way Course Structure There are three volumes in this course This is volume two In volume one I took a deep dive into the world of algorithms I covered what algorithms are how they work and where they can be found real life applications In this part of the series volume two we ll work through an introduction to data structures You re going to learn about two introductory data structures arrays and linked lists You ll look at common operations and how the runtimes of these operations affect our everyday code In the third volume you re going to bring your knowledge of algorithms and data structures together to solve the problem of sorting data using the Merge Sort algorithm We will look at algorithms in two categories sorting and searching You ll implement well known sorting algorithms like Selection Sort Quicksort and Merge Sort You ll also learn basic search algorithms like Sequential Search and Binary Search At the end of many sections of this course short practice exercises are provided to test your understanding of the topic discussed Answers are also provided so you can check how well you have performed in each section At the end of the course you will find a link to download more helpful resources such as codes and screenshots used in this book and more practice exercises You can use them for quick references and revision as well My support link is also provided so you to contact me any time if you have questions or need further help By the end

of this course you will understand what algorithms and data structures are how they are measured and evaluated and how they are used to solve real life problems So everything you need is right here in this book I really hope you ll enjoy it Are you ready Let s dive in   *Algorithms and Data Structures* Niklaus Wirth,1986 From the inventor of Pascal and Modula 2 comes a new version of Niklaus Wirth s classic work Algorithms Plus Data Structure Equals Programs PH l975 This title uses Modula 2 and includes new material on sequential structure searching and priority search trees   **Data Structures and Algorithm Analysis in C++** Mark Allen Weiss,2006 Mark Allen Weiss innovative approach to algorithms and data structures teaches the simultaneous development of sound analytical and programming skills for the advanced data structures course Readers learn how to reduce time constraints and develop programs efficiently by analyzing the feasibility of an algorithm before it is coded The C language is brought up to date and simplified and the Standard Template Library is now fully incorporated throughout the text This Third Edition also features significantly revised coverage of lists stacks queues and trees and an entire chapter dedicated to amortized analysis and advanced data structures such as the Fibonacci heap Known for its clear and friendly writing style Data Structures and Algorithm Analysis in C is logically organized to cover advanced data structures topics from binary heaps to sorting to NP completeness Figures and examples illustrating successive stages of algorithms contribute to Weiss careful rigorous and in depth analysis of each type of algorithm

Algorithms and Data Structures Helmut Knebl,2020-10-31 This is a central topic in any computer science curriculum To distinguish this textbook from others the author considers probabilistic methods as being fundamental for the construction of simple and efficient algorithms and in each chapter at least one problem is solved using a randomized algorithm Data structures are discussed to the extent needed for the implementation of the algorithms The specific algorithms examined were chosen because of their wide field of application This book originates from lectures for undergraduate and graduate students The text assumes experience in programming algorithms especially with elementary data structures such as chained lists queues and stacks It also assumes familiarity with mathematical methods although the author summarizes some basic notations and results from probability theory and related mathematical terminology in the appendices He includes many examples to explain the individual steps of the algorithms and he concludes each chapter with numerous exercises   **Data Structures and Algorithms** Shi Kuo Chang,2003 This is an excellent up to date and easy to use text on data structures and algorithms that is intended for undergraduates in computer science and information science The thirteen chapters written by an international group of experienced teachers cover the fundamental concepts of algorithms and most of the important data structures as well as the concept of interface design The book contains many examples and diagrams Whenever appropriate program codes are included to facilitate learning This book is supported by an international group of authors who are experts on data structures and algorithms through its website at http www cs pitt edu jung GrowingBook so that both teachers and students can benefit from their expertise   *Algorithms and Data Structures*

Kurt Mehlhorn,2012 *Algorithms & Data Structures - When you don't know sh#t* Lyron Foster,2023-03-05 This is a must read book for anyone who wants to learn algorithms and data structures from scratch Written for beginners and intermediate programmers this book provides a step by step guide to understanding the basics of algorithms and data structures and how they can be used to build efficient and scalable software applications The book begins with an introduction to algorithms and data structures explaining their importance in software development and then moves on to cover basic terminology and concepts related to algorithms and data structures The book provides an overview of commonly used algorithms and data structures including arrays linked lists stacks queues trees graphs sorting and searching algorithms dynamic programming and greedy algorithms Readers will learn how to measure algorithm performance identify the best algorithm for a given problem and analyze algorithm time complexity using Big O notation The book also provides best practices for implementing algorithms and data structures in programming highlighting real world applications of algorithms and data structures The book concludes with an introduction to advanced algorithms and data structures such as hash tables tries and heaps Throughout the book readers will find examples and exercises to help them understand and apply the concepts covered in each chapter With this book readers will gain a solid foundation in algorithms and data structures and the ability to apply this knowledge to solve real world problems and build efficient and scalable applications **An Introduction to Data Structures and Algorithms** J.A. Storer,2012-12-06 Data structures and algorithms are presented at the college level in a highly accessible format that presents material with one page displays in a way that will appeal to both teachers and students The thirteen chapters cover Models of Computation Lists Induction and Recursion Trees Algorithm Design Hashing Heaps Balanced Trees Sets Over a Small Universe Graphs Strings Discrete Fourier Transform Parallel Computation Key features Complicated concepts are expressed clearly in a single page with minimal notation and without the clutter of the syntax of a particular programming language algorithms are presented with self explanatory pseudo code Chapters 1 4 focus on elementary concepts the exposition unfolding at a slower pace Sample exercises with solutions are provided Sections that may be skipped for an introductory course are starred Requires only some basic mathematics background and some computer programming experience Chapters 5 13 progress at a faster pace The material is suitable for undergraduates or first year graduates who need only review Chapters 1 4 This book may be used for a one semester introductory course based on Chapters 1 4 and portions of the chapters on algorithm design hashing and graph algorithms and for a one semester advanced course that starts at Chapter 5 A year long course may be based on the entire book Sorting often perceived as rather technical is not treated as a separate chapter but is used in many examples including bubble sort merge sort tree sort heap sort quick sort and several parallel algorithms Also lower bounds on sorting by comparisons are included with the presentation of heaps in the context of lower bounds for comparison based structures Chapter 13 on parallel models of computation is something of a mini book itself and a good way to end a course Although it is not clear what parallel

Objects, Abstraction, Data Structures and Design Elliot B. Koffman,Paul A. T. Wolfgang,2005-10-20 Koffman and Wolfgang introduce data structures in the context of C programming They embed the design and implementation of data structures into the practice of sound software design principles that are introduced early and reinforced by 20 case studies Data structures are introduced in the C STL format whenever possible Each new data structure is introduced by describing its interface in the STL Next one or two simpler applications are discussed then the data structure is implemented following the interface previously introduced Finally additional advanced applications are covered in the case studies and the cases use the STL In the implementation of each data structure the authors encourage students to perform a thorough analysis of the design approach and expected performance before actually undertaking detailed design and implementation Students gain an understanding of why different data structures are needed the applications they are suited for and the advantages and disadvantages of their possible implementations Case studies follow a five step process problem specification analysis design implementation and testing that has been adapted to object oriented programming Students are encouraged to think critically about the five step process and use it in their problem solutions Several problems have extensive discussions of testing and include methods that automate the testing process Some cases are revisited in later chapters and new solutions are provided that use different data structures The text assumes a first course in programming and is designed for Data Structures or the second course in programming especially those courses that include coverage of OO design and algorithms A C primer is provided for students who have taken a course in another programming language or for those who need a review in C Finally more advanced coverage of C is found in an appendix Course Hierarchy Course is the second course in the CS curriculum Required of CS majors Course names include Data Structures and Data Structures Algorithms *Data Structures, Algorithms, and Software Principles* Thomas A. Standish,1994 Based on the idea of experience before essence this book develops the concepts and theory of data structures and algorithm analysis step by step in a gradual fashion proceeding from concrete examples to abstract principles Recurring themes such as recursion levels of abstraction representation efficiency and trade offs unify the material completely **Advanced Algorithms and Data Structures** Marcello La Rocca,2021-08-10 An accessible introduction to the fundamental algorithms used to run the world Richard Vaughan Purple Monkey Collective Advanced Algorithms and Data Structures introduces a collection of algorithms for complex programming challenges in data analysis machine learning and graph computing Summary As a software engineer you ll encounter countless programming challenges that initially seem confusing difficult or even impossible Don t despair Many of these new problems already have well established solutions Advanced Algorithms and Data Structures teaches you powerful approaches to a wide range of tricky coding challenges that you can adapt and apply to your own applications Providing a balanced blend of classic advanced and new algorithms this practical guide upgrades your programming toolbox with new perspectives and hands on techniques Purchase of the print book includes a free eBook in PDF Kindle and ePub

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