

Preface

This lab manual contains a collection of lab exercises and projects that have been used successfully in my CS2 course for the past several years. They are coordinated with the material in the first 14 chapters of my text *ADTs, Data Structures, and Problem Solving with C++*, 2E. (For more information about the text see the website at cs.calvin.edu/books/c++/ds/2e .)

For most of the lab exercises, there is a corresponding project that builds on the lab. But in a few cases, there are two projects. It is not intended that both projects be assigned but rather that one be selected that best fits the content and nature of your course. Also, in two cases, there are two labs and two projects for a single chapter (Chap. 2 & Chap. 10). Here too, one can pick and choose a combination of them.

Some of the labs and projects may have more material that is appropriate for your course. Almost all of them are designed, however, in such a way that parts of them may be omitted or replaced.

Typically, each lab involves a file that students use as they work through the lab exercise, modifying it, compiling and executing it, and reporting what happens. Listings of these files are included in *Appendix: Files*, but they can also be downloaded from the website for this lab manual:

<http://cs.calvin.edu/books/c++/ds/2e/labmanual>

An errata list is also available there and other items are planned.

The lab exercises and projects have all been used in a course in which some students worked in Unix-based gnu C++ and others used Microsoft's Visual C++ or Metrowerks' CodeWarrior C++. They should all compile, link, and execute in any environment that supports ANSI standard C++. Any problems or necessary modifications that are reported to me will be posted at the website given above.

Corrections, comments, and suggestions about the lab exercises and projects are appreciated. You can e-mail them to me at the address below. Also feel free to contact me if there are difficulties with accessing items at the above website or if you have other questions.

Larry Nyhoff
Calvin College
Dept. of Computer Science
nyhl@calvin.edu

TABLE OF CONTENTS

Lab 1.1 Black-box and White-box Program Testing	1
Lab 2.1 Exploring Addressing	9
Project 2.1 Binary Representation.....	15
Lab 2.2 Create Your Own Types — Enumerations	19
Project 2.2 Rock Operations	29
Lab 3.1 Arrays and Addresses	35
Project 3.2 Multidimensional Arrays — Magic Squares.....	45
Lab 4.1 Enumeration Classes — Classy Rocks	51
Project 4.1 More Classy Rocks — Continuation of Lab 4.1.....	61
Lab 5.1 Linked Lists	67
Project 5.1 More Linked Lists	81
Project 5.2 Application of Linked Lists: Hash Tables.....	87
Lab 6.1 Queues.....	91
Project 6.1 An Improved Queue Class	101
Project 6.2 Queues — A Circular Linked Implementation.....	103
Lab 7.1 Templates — Introduction to <code>vectors</code>	105
Project 7.1 <code>vectors</code> of System Tasks.....	117
Project 7.2 Building and Using a Queue Template	119
Lab 8.1 Recursion — Hand Tracing.....	121
Project 8.1 Recursion — Machine-Tracing.....	131
Lab 9.1 Measuring Algorithm Efficiency.....	137
Project 9.1 Exploring and Comparing Algorithms.....	143
Lab 10.1 Binary Search Trees	149
Project 10.1 More About BSTs — Concordance.....	155
Lab 11.1 Sorting	161
Project 11.1 More Sorting & Algorithm Analysis	173
Lab 12.1 Inheritance	177
Project 12.1 Inheritance: Data Sets	187
Appendix: Files.....	191

