

IPRO 328 Final Report

Developing a Computer Science Text with Practical Open-Ended Problems

Instructor: David Grossman, in consultation with Ophir Frieder

Team leader: Yacin Nadji, 3rd year C.S.

Team: David Charles Allen, 5th year Political Science
Nicholas Bathum, 3rd year Computer Science
Katherine Hammes, 3rd year Chemical Engineering
Seon Jeong, 4th year Mechanical Engineering
Leland Johnson, 4th year Computer Science
Roman Kofman, 4th year Computer Science
Noh Hyup Kwak, 4th year Electrical Engineering
Vivek Patel, 3rd year Biochemistry
Phillip Rymek, 3rd year Computer Science
Peter Schmitz, 3rd year Computer Science
Michael Tilatti, 3rd year Aerospace Engineering
Harry Tran, 3rd year Biomedical Engineering

Illinois Institute of Technology

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Planning

Problem

Problem Described

The impulse behind this IPRO is dissatisfaction with the textbooks currently used to teach introductory computer science. In most cases, introductory books focus on a specific programming language, as opposed to the overarching principles of computer science. The language should be seen as a tool for the student to use, helping them to learn problem solving techniques with a focus on algorithms. Most textbooks allow themselves to be bogged down by the specific nuances of this tool, instead of learning problem solving. We aim to fix this with a book that actually focuses on the algorithms, not the tools.

Imagine trying to teach a child English. If you start by teaching him individual vocabulary words and derivations he will still not be able to communicate. It is first necessary to teach him sentence structure, common sense, and how to tie words together to express coherent thoughts. If he understands the fundamentals of communication, he will be able to communicate in any language by learning the specifics of that language.

The need for an alternative book for teaching introductory computer science exists, and it is the goal of this IPRO to develop that book.

Why the Problem Exists

It would be optimal to teach computer science without having a dependence on the tool or programming language. However, in order to ensure that the student understands the fundamental concepts and is able to use them together in a larger project, it is necessary to use the programming language to teach the concepts. The problem arises when textbooks focus more on the language itself than on the problem solving techniques. These textbooks have exercises and examples geared toward testing the student's understanding of syntax and language-specific attributes. This is the precedent that has been evident in other introductory texts, and is a commonly seen flaw.

We hope to reverse this trend by shifting the focus away from the specifics of a particular programming language and use it only as a laboratory for the students to execute their understanding of the fundamentals of programming. Our problems will demand the use of algorithms and problem solving techniques with minimal testing of knowledge of the language.

To study the trend of monolithic, programming language specific textbooks, we conducted a survey of typical books used in colleges across the Midwest. The results of the survey, pictured in the table below, confirmed our fears.

Book Title	Page Count
A First Look at C++: From Here to There	816
An Introduction to Object-Oriented Programming With Java	976
Applied C: An Introduction and More	1136
C++ How to Program	1536
Computer Science: A Structured Programming Approach Using C	928
Java 5 Illuminated: An Active Learning Approach	1177

Our book is a stark contrast to the other books. It is short and succinct, and yet was successfully used during the semester to give 7 students an introduction to computer science. Why do other textbooks need to spend time best measured in kilograms instead of pages, when less covers the material more precisely and clearly?

Ethical Issues Raised

The IPRO team must ensure that the book we draft appeals to all types of students that may be in an introductory computer science course. This means keeping in mind that the book needs to be approachable to males and females from all backgrounds, and to people with minimal programming experience. At the same time, we must make sure that each chapter covers all aspects of the particular topic that a student taking an introductory computer science course would be expected to know. This can be facilitated through the peer review process we have in place.

Team members may intentionally, or through a lack of review, create a textbook that leans toward a particular set of moral values, or favors a certain faith. There is also the danger of estranging religious students by writing from a point of view that implicitly attacks religion. Team members may not take into account how approachable the text is for a person from a different cultural background. Since the exercises and examples deal with real-world scenarios, scenarios specific to a certain culture and unknown to other cultures can possibly be created. In any of these cases, certain students would be disadvantaged when trying to study from this text due to their religious or ethnic background: such an outcome would be discriminatory and immoral.

In addition, ethical considerations were raised with regards to the methods and communication of the IPRO team, but this will be described in further detail in Section 11.

Background and Objectives/Goals

Project Objectives

The objective of this IPRO team is to improve upon an introductory computer science text developed last semester that focuses on critical thinking and problem solving. The key deliverables entailed in this undertaking specifically include:

- Improving chapter content and layout
- Adding/deleting/changing chapter figures
- Revising exercises
- Updating exercise solutions to revised exercises
- Creating Lecture Notes for the book
- Updating website

Current Team Objectives Compared to Past and Future Teams

Last semester's team of Fall 2007 was the first team to work on this IPRO. Their objectives were as follows:

- Refine the eight chapters of drafted text, with each chapter including the tasks:
 - Improve and edit the text itself
 - Develop 20-30 exercises, including several open-ended
 - Include the solutions to the exercises
 - Develop 5-6 programming examples
 - Create figures and accompaniments where necessary
- Website, including:
 - MEAs (see below)
 - Supplementary material for text
 - IPRO specifications
- Develop 2 Model-Eliciting Activities

These objectives were accomplished. This semester, we focused on testing the results of last semester. With a more interprofessional team, valuable feedback from doing the exercises came quickly and easily. Both semesters edited the book. The Fall 2007 semester strengths were in finding technical errors and in identifying problems students may have. This semester added to these strengths, by having a strong editing team that improved the coherency of the book and students that had not taken an introductory course before. These students very quickly revealed holes in the text as they worked on the chapter exercises.

Future teams should continue testing and revising the book, its chapters, and its exercises. As this iterative process improves the book, the use of the book in real classrooms and publication of the book should be investigated.

Project Background

Dr. Ophir Frieder and Dr. David Grossman have completed a draft manuscript for an introductory book on Computer Science. In Fall 2007, the IPRO developed problem sets with solutions for the book, improved its examples, and developed sidebars. This semester, the IPRO will focus on testing the book with students new to computer science. The impulse behind this book is dissatisfaction with the way introductory computer science is currently taught. To our knowledge, there has yet to exist a text that focuses on semantic and algorithmic issues, rather

than purely syntactical. Most students get bogged down by the intricacies of the programming language itself, which hinders their problem solving development. This book, in contrast to its many predecessors, will use the Ruby programming language. The language offers some good pedagogical aspects and this is couple with the fact that it is also becoming extremely popular in industry (e.g. 37Signals, as featured in BusinessWeek). By using Ruby, the team aims to aid students in learning semantic and algorithmic issues rather than the syntactical problems they face when learning other languages such as C++ and Java.

Methodology, Assignments, and Contribution

Project's Methodology

Research

The crux of this project – dissatisfaction with current computer science teaching methods – was not directly researched, but was experienced firsthand by Professor Grossman, as well as members of the IPRO team. To gain insight into how computer science topics are currently taught other books were examined, and team members reflected on any previous computer science courses. Most of the members of the IPRO are non computer science majors and were thus ideal candidates for testing the manner in which the textbook conveys concepts and information. Those who were already familiar with these principles helped served to verify the correctness of the material.

Sub-Team Breakdown

Initially the exercise team was responsible for completing exercises from a chapter, to test the quality of the exercises. Near the end of the IPRO, the exercise team shifted focus to revising the tested exercises. The technical team was responsible for preparing presentation materials, explaining the concepts in each chapter, and grading the homework problems. The editing teams were responsible for taking comments on the chapters, and outlining and rewriting the chapters in the textbook. The following is a list of sub teams with team members assigned:

- Exercise Team
 - Vivek*, Nick, Noh, Seon, Pete, David, Mike
- Technical & Grading Team
 - Leland, Phil
- Website Development Team
 - Harry
- IPRO Deliverables Team
 - Deliverables are assigned to different members accordingly.
- Editing Team
 - Katherine*, Roman*, Phil, Harry
- Editing Team Two
 - Nick, Pete

* Denotes a sub-team leader

Weekly Schedule

The team met each week on Mondays for two class periods. In class we focused on book work, IPRO deliverables, and status reports of each sub-group. The teams also met Thursday nights via internet relay chat (IRC) to make sure members were staying on task and knew what their tasks for the weekend were. The policy for hours for each member was to work ten hours per week outside of class, with five of those hours being completed by the Thursday night meeting. In addition, each member submitted a weekly report, used the time reporting application on iGroups.

Due to the structure of the textbook, each chapter had to be subjected to the same revision process. A three-week cycle of editing with seven phases was developed:

- Day 1: The chapter will be presented and the team will agree to a general outline of the chapter.
- Day 6: The exercise team will be assigned exercises at the end of the chapter.
- Day 8: The exercise team will provide feedback on the exercises at the end of the chapter.
- Day 11: The technical team will grade the exercises done by the exercise team and provide feedback on their performance. The editing sub-team will begin rewriting the chapter based on provided comments.
- Day 17: The editing sub-team will finish rewriting the chapter make minor changes if necessary. The entire team will then begin looking at the final product and make minor suggestions.
- Day 21: The final draft of the chapter will be completed.

Overview of Assignments

There are a few main categories of assignments, each with several more detailed sub assignments, which will be broken down and explained in Section 4. These main assignments include:

- Revise all chapters of the previous book
- Revise all exercises in each chapter
- Develop lecture notes for the book
- Publish a website to satisfy both IPRO requirements and support the book, including instructor solutions, code examples, and other resources
- Submit IPRO deliverables

Member Contribution

David Charles Allen, Fifth year Political Science

- Wrote Project Plan
- Delivered midterm presentation
- Member of the exercise sub-team
- Member of the editing sub-team

Nicholas Bathum, Third year Computer Science

- Edited chapters 9 and 10
- Wrote the Code of Ethics
- Contributed to exercise sub-team for chapters 1 through 6
- Attended IPRO Games
- Wrote Final Report

Katherine Hammes, Third year Chemical Engineering

- Edited chapters 1 through 7
- Co-Chair of editing sub-team
- Attended presentation workshop
- Wrote and Delivered the Final Presentation

Seon Jeong, Fourth year Mechanical Engineering

- Attended IPRO Ethics workshop
- Member of the exercise sub-team
- Commented on the new chapters
- Member of poster team

Leland Johnson, Fourth year Computer Science

- Implemented "Exercise Tracker"
- Graded exercises
- Lecturer for chapters 6 through 9
- Member of Final Report Team

Roman Kofman, Fourth year Computer Science

- Co-leader of Editing Subteam
- Edited chapters 1 through 8
- Lecturer for chapters 1 and 2
- Created and Delivered the Final Presentation

Noh Hyup Kwak, Fourth year Electrical Engineering

- Member of exercise sub-team
- Commented on each new chapters
- Created and modified exercise problems for chapter 2 through 7
- Member of poster team

Vivek Patel, Third year Biochemistry

- Member of exercise sub-team
- Wrote Midterm Report
- Updated exercises with exercise subteam for chapters 2 through 8
- Commented on each new chapters

Phillip Rymek, Third year Computer Science

- Edited chapters 1 through 8
- Revised chapter 1 problems
- Identified problems to modify for chapters 2 through 8
- Lecturer for chapters 2 through 4
- Graded exercises
- Led poster creation team

Peter Schmitz, Third year Computer Science

- Edited chapters 9 and 10
- Created Brochure
- Contributed to Exercise sub-team for chapters 1 through 4
- Commented on chapters 1 through 8
- Attended IPRO Games

Michael Tilatti, Third year Aerospace Engineering

- Delivered Midterm Presentation
- Commented on chapters 1 through 10
- Did exercises for chapters 1 through 9

Harry Tran, Third year Biomedical Engineering

- Edited chapters 1 through 8
- Wrote Project Plan
- Wrote Meeting Minutes
- Designed Website

Organizing

Assignments

Major Task Assignments

The tasks for each chapter of the book were assigned to the members of the chapter subteam and included the following:

- Revise all chapters of the previous book - Editing Teams
- Revise all exercises in each chapter - Exercise Team
- Develop lecture notes for the book - Technical Team
- Publish a website to satisfy both IPRO requirements and support the book, including instructor solutions, code examples, and other resources - Website Development Team
- Submit IPRO deliverables

The following IPRO deliverables were assigned as tasks as specified:

- Project Plan: Harry
- Midterm Report: Vivek
- IPRO Day Poster: Noh, Seon, Phil
- Final Report: Nick, Leland
- Meeting Minutes: Harry
- CD-ROM: Phil
- Abstract: Pete
- The IPRO Day Presentation: A collaboration of the entire team
- Weekly Reports: Everyone

Major Team Roles

The major team roles are sufficiently described in Sections 3.1.2, 3.3, and 4.1.

Acknowledgements

References and Resources

To judge the quality of the book, it was compared to the following computer science textbooks.

- Pine, C. 2006 *Learn to Program (Pragmatic Programmers)*. Pragmatic Bookshelf.
- Cohoon, J. P. and Davidson, J. W. 1998 *C++ Program Design: an Introduction to Programming and Object-Oriented Design*. 2nd. McGraw-Hill, Inc.
- Sierra, K., Allen, R., and Bates, B. 2003 *Head First Java*. O'Reilly & Associates, Inc.
- Knuth, D. E. 1997 *The Art of Computer Programming, Volume 1 (3rd Ed.): Fundamental Algorithms*. Addison Wesley Longman Publishing Co., Inc.

Contributing Parties

- Dr. Ophir Frieder of the Illinois Institute of Technology Computer Science Department assisted Professor Grossman in writing the initial rough drafts of the text.
- Candace Say of the IPRO Office was very useful in providing feedback for IPRO Deliverables and answering any questions we had.
- Elizabeth Howard of the IPRO Office reviewed and provided feedback for the Code of Ethics.

CD-ROM Table of Contents

Directory of D:

S08 Syllabus 328.doc
iKnow Deliverables
IPRO328 Accomplishments
Team Information.bmp

Directory of D:\iKnow Deliverables

Abstract
Code of Ethics
Final Presentation
Final Report
Meeting Minutes
Midterm Presentation
Poster
Project Plan
Website

Directory of D:\iKnow Deliverables\Abstract

IPRO328_Abstract_FINAL_EDITION.pdf

Directory of D:\iKnow Deliverables\Code of Ethics

CodeEthicsNew.pdf

Directory of D:\iKnow Deliverables\Final Presentation

IPRO328 Final Presentation 17Apr108.ppt

Directory of D:\iKnow Deliverables\Final Report

IPRO328 Final Report.pdf

Directory of D:\iKnow Deliverables\Meeting Minutes

minutes - 02.04.2008.pdf
minutes - 02.11.2008.pdf
minutes - 02.18.2008.pdf
minutes - 02.25.2008.pdf
minutes - 03.03.2008.pdf
minutes - 03.10.2008.pdf
minutes - 03.24.2008.pdf
minutes - 03.31.2008.pdf
minutes - 04.07.2008.pdf
minutes - 04.14.2008.pdf
minutes - 04.28.2008.pdf

**Directory of D:\iKnow Deliverables\Midterm Presentation\
IPRO328_midtermSpring2008.ppt**

**Directory of D:\iKnow Deliverables\Midterm Report\
Midterm Report IPRO 328 s08.doc**

**Directory of D:\iKnow Deliverables\Poster\
IPRO328PostersFinal.pdf**

**Directory of D:\iKnow Deliverables\Project Plan\
Project Plan Draft 03.doc**

**Directory of D:\iKnow Deliverables\Website\
images
programs
chapters.html
examples.html
examples_ch1.html
examples_ch10.html
examples_ch2.html
examples_ch3.html
examples_ch4.html
examples_ch5.html
examples_ch6.html
examples_ch7.html
examples_ch8.html
examples_ch9.html
index.html
layout.css
links.html
preface.html
presentation.css
problems.html
problems_ch1.html
problems_ch10.html
problems_ch2.html
problems_ch3.html
problems_ch4.html
problems_ch5.html
problems_ch6.html
problems_ch9.html
solutions_ch1.html
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solutions_ch6.html
solutions_ch9.html**

**Directory of D:\IPRO328 Accomplishments\
Completed Exercises
Exercise Tracker
Lecture Notes
New Book
Old Book**

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Completed Exercises**

Chap1
Chap2
Chap3
Chap4
Chap5
Chap6
Chap7
Chap9

**Directory of D:\IPRO328 Accomplishments\Completed Exercises\Chap1\
ch 1 exercise hw.doc
Chapter 1.txt
DA_PS1.doc
ipro_problems.txt
Michael Tilatti Chapter 1 4,8,12,16,20,24.txt
probs_kwak.txt
pschmitz_hw1_GroupC.txt
VPatel_GroupA.txt**

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Ch2 HW From Seon Jeong.doc
Chapter 2 Problems.doc
DA_CH2_Exercises.rtf
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prob_kwak_ch2.txt
pschmitz_ch2_homework.txt
Vivek_Chap2_5_6_12_14_19_20_26.txt**

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Ch3 exercise by Seon Jeong.doc
ch3_problems_NickBathum.txt
Ch3DA.zip
exercise3kwak.txt
pschmitz_ch3_hw.txt
Vivek_Chap3.txt**

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bathum-ch4.txt
DA_4.rtf
exercise4kwak.txt
Michael Tilatti Chapter 4 5,10,15,20,21.txt
pschmitz_ch4_hw.txt
seon jeong ch4 exercise.
Vivek_Chap4.txt**

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exercise ch 5 (#5.1-#5.13) from SeonJeong.txt
exercise5kwak.txt
Michael Tilatti Chapter 5 1-13.txt
Vivek_Chap5.txt**

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first submission
second submission**

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DA_c6ex.rtf
exercise ch 6(1-11).txt
exercise6kwak.txt
Michael Tilatti Chapter 6 #19.doc
Michael Tilatti Chapter 6 12-22.txt
Vivek_Chap6.txt**

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DA_6_exs.doc
exercise 6.txt
exercise6kwak2.txt
Michael Tilatti Chapter #6,9,12,15,18.txt
Vivek_Chapter6-7.txt**

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exercise7kwak.txt
hw ch7.txt**

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da_9.txt
exercise9kwak.txt
exercisech9.txt**

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IPRO328 Exercise Tracker.xls**

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Chap1.ppt
Chap2.ppt
Chap3.ppt
Chap4.ppt
Chap5.ppt
chap6.ppt
chap7.ppt
chap8.ppt
chap9.ppt**

**Directory of D:\IPRO328 Accomplishments\New book\
New Book Final.pdf**

**Directory of D:\IPRO328 Accomplishments\Old book\
Compilation_1-8-v3.pdf**

Controlling

Resource Control

Major Task Assignments and Team Roles Controlled

After the submission of the project plan, Katherine left the Exercise Team to become the leader of the Editing Team. Do to time concerns, a second Editing Team was formed to finish editing all the chapters in our timeframe. The Exercise Team was also given the responsibility of revising the exercises, as it became apparent that the Technical Team would not have enough resources to complete the required revisions.

Concluding

Conclusions and Completion Activities

Obstacles Encountered

I PRO 328 has encountered a range of obstacles during the course of the semester. The obstacles included serious obstacles in communication and accountability that had to be dealt with. Fortunately, I PRO 328 has quickly cleared these barriers.

Communication is a team faculty that is difficult to fully use. There exists a gamut of new technological channels for communication, and yet people are reluctant to talk to each other. Fortunately, the I PRO 328 advisor continually emphasized communication and the role it should take inside the I PRO team. Thus, the goals of debriefing each other, ascertaining whether or not team members have done their work, asking or offering help with no inhibition and sharing information was met in two weeks. Currently, I PRO 328 communicates daily, sometimes hourly, to accomplish tasks efficiently and on time.

There was a definite time constraint put on this team because two chapters were added to the book's previous content that had to be edited along with the other chapters before the end of the semester. To overcome this, a development cycle was created for all the chapters to be revised through. The development cycle allowed multiple chapters to be edited in stages, significantly shortening the time required for revision overall. In addition, a second editing sub-team was spawned to edit the last two chapters.

Writing the chapters in a cohesive manner across two editing sub-teams was another difficult obstacle to overcome. By subjecting each chapter to peer review during the revision process, inconsistencies in the text were more easily found. To remedy any inconsistencies the editing team collaborated to fix the text in manner that fit with the rest of the text. If this is done well, the chapters will be consistent and thus, more coherent. Special attention was given to the last two chapters, as they were written by a secondary editing team, so the book should have a single voice and tone.

There are a few trivial obstacles this team had to overcome. For example, the emphasis on algorithms and problem-solving in the text is clearly an important goal. However, focusing on the general is often difficult. The team balanced practical Ruby knowledge with general algorithm and problem solving knowledge by collaborating and reviewing each chapter. Likewise, it is very easy to mention terms that are so familiar to the writers but so obscure to the students. This is a problem for every book, and is handled by either asking a freshman's advice, or carefully reviewing the text for assumptions. Also, it is difficult to find a time where twelve people are available to meet outside of class. After reviewing all team members' availability, we decided to meet in online chat Thursday nights at 10pm. These obstacles, though seemingly simple, are worthy to mention because they were a constant challenge through the book's development.

Findings and Results

The results of the IPRO are as follows:

Textbook: The eight chapters that existed at the beginning of the IPRO have been edited and rearranged so that content is arranged in a logical manner. In addition, two more chapters have been split from existing chapters to keep chapter size consistent. Exercises in the first eight chapters were revised or replaced. The following chart shows quantitatively the work done on the book:

Task	Hours
Chapter Text Insertion/Deletions	1015
Incorporated Comments	815
Changed Exercises	23
New Exercises	35
Total	1100.9

Teaching Materials: Additional teaching materials were created, to complement the book. Besides the text of the book, examples, and exercises, lectures were held and lecture notes were produced. The teaching materials produced are as follows:

- 9 Mock Lectures done during Monday meetings
- Lecture Notes for 9 Chapters
 - Includes 197 PowerPoint slides

Website: The website is up and running with descriptions of the book and its chapters, code examples, and problem solutions. It can be found at:

<http://omega.cs.iit.edu/~ipro328-spring08/>

IPRO Deliverables: All IPRO deliverables were completed and submitted on time. The known results are as follows:

- Project Plan - 14/14
- Midterm Report - 16/16
- Code of Ethics - 16/16

Conclusions

The team achieved its listed objectives, modifying desired goals when necessary, and is happy with its final products. Based upon the successful revision of the entire text, the team has concluded that the new version of the text is more focused and cohesive than the last. The text is written with a more general focus, stripped of unnecessary content, and the content has been organized in a more logical manner. The IPRO deliverables were created collaboratively by team members, and their scores speak for themselves.

Furthermore, the team was pleased with its methodology. Meetings were run efficiently and were used primarily for group communication and status updates, and the amount of work done outside the classroom was controlled and sufficient. The team's communication was exemplary, making extensive use of iGroups to post material and email to keep everyone in touch. This was especially evident toward the end of the semester as the team started realizing its goals and putting the finishing touches on projects.

Implications of Conclusions

The conclusions reached by this IPRO imply that an introductory computer science course that focuses on open-ended problems and problem solving techniques with minimal focus on specific programming language is a viable and preferable alternative to the current teaching methods. A shift to this style of teaching would produce students who are more prepared for large-scale programming projects, better at planning and logically organizing programs, and more versatile in using several languages. Specifically the new text is a better teaching tool than the previous text.

Equipment and Cost Accounting

All work was done on team members' personal computers, and products were digital. The only equipment used was the IIT Computer Science Department's copy machine to make copies of chapters, IPRO deliverables, and other handouts for meetings. This usage mirrored a typical computer science course.

The team had no budget, and did not spend any money.

Hours Accounted For

The team completed 1100.9 hours of work toward the project. This is broken down by member below:

Member	Total Time Spent
David Allen	93.2
Nicholas Bathum	80.3
Katherine Hammes	112.0
Seon Jeong	96.0
Leland Johnson	84.3
Roman Kofman	81.9
Noh Hyup Kwak	96.0
Vivek Patel	89.8
Philip Rymek	96.5
Peter Schmitz	72.3
Michael Tilatti	86.0
Harry Tran	112.6
Total	1100.9

Recommendations

Recommended Next Steps

The scope of this IPRO was to develop the text and lecture notes, text the exercises in a laboratory classroom setting and update the website. It did not include preparing the book for use in real classrooms, publication, providing a business plan, or finding a publisher.

Therefore, the recommended next steps for this IPRO are as follows:

Overall the book has a simple, but acceptable appearance. Common conventions, such as italicized variables and code highlighting were followed to assist the reader's comprehension. We would recommend that a knowledgeable person or professional services be used to unify the book's appearance into a more pleasing and helpful design. This process must be automated in some way, or it should not be acceptable. Much time was spent manually

formatting the book in the previous semester, and this should be avoided.

We believe the reason behind the book's creation is solid, but there is no business plan that describes the benefits of the book. This would encourage someone to take interest in it from a business standpoint, such as a publisher. Finding a publisher for the book should be a key task. The overarching goal has always been to use the text in a real introductory course. If a publisher proves too difficult to find, there are other avenues to get the book in use, such as posting it on the internet or use in local IIT classrooms.

Next Steps Related to Findings

The IPRO team feels strongly that this book and teaching strategy are viable for actual in-class learning. Hence, the next steps to take with this IPRO and project are to get the book into a real classroom environment. This would entail distribution to real high school and college classrooms and perhaps publishing.

Recommendations to Sponsors

This IPRO had no sponsors.

Learning

Teamwork

Teambuilding Activities

The Thursday night meetings increased team communication and hence fostered teambuilding across the IPRO team. Also, dividing the group into sub-teams allowed for more intimate working conditions, which led to a stronger team overall. The weekly reports, timesheet use, and Thursday night meetings ensured that members were accountable to each other.

Several members attended the IPRO Games and other IPRO workshops. Also, Professor Grossman promised pizza if the team received perfect scores on the IPRO deliverables, and this motivated the team to do well on those deliverables. Because the team reached the requirements, we had pizza during three Monday meetings.

Teamwork Effectiveness Evaluation

The teamwork was effective throughout the semester. After the first couple weeks of breaking ice, the communication was superb, which allowed the team to stay organized and achieve goals. There were always volunteers to take on tasks, members upheld their time commitment obligations, and there was minimal arguing that was not constructive. Respect was maintained throughout. In addition, each team member completed a peer review of entire team. The results of the peer review were very positive, and reinforced the drive of the team.

Resolution of Teamwork Problems

Early in the semester, communication was not at a satisfactory level. After a couple weeks Professor Grossman laid down guidelines for communication that were then followed. This increased communication and productivity.

Other problems with teamwork included how to divide the group into sub-teams and when to meet outside of class. Both of these problems were addressed in Section 7.1.

Communication

Communication Activities

In addition to the Monday class meeting, which was primarily for group communication and status reports, the team had Thursday night meetings in an online chat room. This allowed Yacin Nadji to monitor the team's progress and ensured that work was being done throughout the week. Obstacles and conflicts could also be identified and resolved in the online chat, since every team member would be present. The editing teams also had weekly meeting times outside of class to discuss revisions suggested over the week.

Each member of the team also submitted weekly reports on Sunday nights to Professor Grossman detailing what they did that week, whether they met his objectives for the week, what problems they faced, and what their plans were for the next week. This was accompanied by use of the timesheet application on iGroups so that Professor Grossman could be sure that each member was contributing and on task.

Email was the most commonly used communication method within sub-groups. Occasionally if an urgent request needed to be made or someone was away from their email for too long, phone calls were made. The teams made extensive use of iGroups for uploading documents and posting revisions. This enabled communication between several people on a single document in an organized manner.

The iGroups peer review system was also utilized, and it showed the team which members were doing more than their part, and which members needed to improve their work within the IPRO.

The exercise team and technical used a Google Docs spreadsheet to keep track of solution submission and grades. Initially, excel spreadsheets were used, but merging them together was deemed too time-consuming compared to the ease of the Google Docs solution.

In order to keep tasks and important dates in mind, the team also used the to-do list and calendar features of iGroups.

Communication Effectiveness Evaluated

The team's communication was tentative at first, but soon became excellent. Important dates and events were always discussed in class, and a team member was responsible for each deliverable. Without the excellent communication, the organization of the IPRO would have been impossible, and the goals would not have been fulfilled. The scores on the IPRO deliverables demonstrate the high levels of organization and communication that were present throughout the semester.

Also, the team completed IPRO deliverables in advance and sent them to members of the IPRO office for review before submitting them. This external communication gave insights as to what the IPRO office was looking for, and allowed the team to improve their deliverables accordingly.

Resolution of Team Communication Problems

The introduction of the Google Docs exercise tracker caused some confusion, as team members now did not have to email their exercise work to one person for aggregation. However, after using the new exercise tracker for a chapter, it improved the turnaround time of exercise solutions and grading, eliminating the bottleneck of the solution and grade aggregator role. This allowed the exercise team to report their progress to the technical team faster and easier, and allowed the technical team to communicate the grades back with the same expediency.

Ethical Behavior

Ethical Issues Resolved

Several ethical issues were raised with regards to ensuring that the text appealed equally to all student demographics, as described in Section 1.3. It was important that members did not insert their own beliefs, backgrounds, or politics into the book. In this regard the book needed to be written as objectively as possible so as not to offend any potential readers.

Some members of the IPRO team have taken multiple computer science courses, so the issue of plagiarism was present. Obviously problems and text were not directly copied from other sources, but it is possible that members were inspired on problems by ones that they had seen in books in past courses. However, all work was original and contrived by the team members, so the danger lies in mere subconscious influences by other books, which is not enough to warrant concern.

Since the team made extensive use of Time Reporting and weekly reports, it was imperative that members gave accurate accounts of the time spent on tasks. In the beginning of the semester this was called into question, but was quickly amended.

Feedback played a crucial role throughout the development of all deliverables, so it was important that the team maintained honesty and integrity when communicating. A failure to give one's complete opinion could result in other ethical issues being missed. Thus it was important that members were honest with each other and with themselves.

Resolution of Team Ethical Issues

All ethical issues pertaining to certain biases or instances of discrimination in the text were sorted out by the extensive peer review that was done on the book. Each member was responsible for reviewing every part of the book for such issues. In addition, the team spent several class periods reviewing the written material, and any issues were brought up on the spot and a better alternative was found. This was a sufficient handling of these ethical issues within the scope of this IPRO. It is up to future teams to further refine the text and test it with a multitude of cultural backgrounds to ensure its objectivity.

The ethical issues that arose in the IPRO team's methods and communications were resolved by confronting them head on in class. The team adopted a policy of being precise and efficient in communication. This policy risked offending team members as their work might be criticized, but everyone understood that such criticism was in the best interests of the IPRO.

Reasons for Ethical Issues

In any population, there will be differing backgrounds, cultures, and beliefs, especially in a population as diverse as a college campus. This has benefits, as more perspectives can lead to more ideas and innovations. However, there is also a wider range of possible biases and a higher probability of offending certain groups. This played two main roles in this IPRO:

Computer science, especially in its introductory stages, is mostly an objective discipline. The student has the freedom to exert his own ideologies in solutions and techniques, but the material must be presented in an objective manner so as to not intimidate or present unnecessary barriers for new students. This is different from other fields such as sociology or philosophy, where one's beliefs are vital to the curriculum.

The diversity of backgrounds also played a part within the team. Each member has different experiences with computer science, different methods of learning, and different visions for the deliverables. Thus there exist issues related to tying all of these backgrounds and beliefs together into a cohesive unit with a unified purpose.