

# SLICE

## Software **L**inked **I**nteractive **C**ompetitive **E**nvironment Software Plan

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Requested by:

**Dr. Darren Lim**

Professor of Computer Science

Siena College

Loudonville, NY

Prepared by:

**P=NP***solutions*

Zachary Fitzsimmons – Team Leader

Michael Pepe – Team Lieutenant

Anthony Parente – Systems Administrator

Matthew Ferritto – Webmaster

Renee Solheim – Document Analyst

September 23<sup>rd</sup>, 2011

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# Chapter 1

## System Definition

### 1.1 Problem Definition

Competitive programming contests are held at all different levels and scales, with a few teams to up to many participants and from single network sessions to across the world through the internet. Currently Dr. Darren Lim holds a programming contest at Siena College for local area high school students, with the number of teams approaching twenty. In the Spring of 2013, Siena College will be holding the CCSCNE (Consortium for Computer Science in Small Colleges North East) Conference, which includes a programming contest. Currently the software available is not user friendly and consists of several different parts. Dr. Darren Lim has requested that we create an integrated system for problem submission and judging for a competitive programming contest.

### 1.2 System Justification

The purpose of this software is to allow fast, both manual and automatic judging during a competitive programming contest and to integrate the submission, judging and scoreboard of a contest into one single application. Currently Dr. Darren Lim employs a solution that functions as multiple pieces and requires judging to be done through the command-line or by importing the submission into an IDE. Not only is this time consuming, but it allows no security against malicious code.

### 1.3 Goals for the System and the Project

The goal of S.L.I.C.E. is to implement a fully functional integrated competitive programming environment. Our Client, Dr. Darren Lim wants a solution that blends the different aspects of holding a programming contest (messaging, submissions, judging) into one seamless solution.

## 1.4 Constraints for the System and on the Project

During a programming contest, the sheer amount of participants and judges required does not guarantee that they will all be running the same hardware and software suites. Therefore, S.L.I.C.E. will be able to be run on all four major web-browsers (Microsoft Internet Explorer, Mozilla Firefox, Apple Safari and Google Chrome) as well as using the central server for the system for compilation and testing of submitted programs.

## 1.5 Functions to be Provided

The following functions will be provided in the final solution:

- The ability for participants to submit source code in a variety of languages for judging
- Automatic compilation and testing of submitted solutions
- The ability for judges to review the output of automatic judging
- Messaging between judges and one/all teams
- Load balancing submitted problems and questions for judges

## 1.6 User Characteristics

There will be two different types of users for this system:

- Judges must be able to
  - view participant submitted solutions that the system will compile and run the submitted programs to grade the output
  - send/receive questions from participants as well as broadcast answers to all participants
- Participants must be able to
  - submit solution source code for a certain problem in a certain language
  - ask clarifying questions that should be answered by the judges
  - view a leader-board of the total time for all participants of the contest

## 1.7 Environments

### 1.7.1 Development Environment – Roger Bacon Hall 360

Our PC is an Optiplex 760 (name: seb2)

- Windows Vista Enterprise (32 bit) with service pack 1 installed
- An Intel Core2 Duo CPU processor (E7500 @ 2.93GHz)
- 4 GB of Memory

Our Mac is an iMac (model identifier: iMac5,1)

- Mac OS X, version 10.6.4
- An Intel Core 2 Duo Processor (667 MHz)
- 1 GB of Memory

Our server is an x86\_64 PC

- Hostname: oraserv.cs.siena.edu
- CentOS 5.2 (final)
- Kernal: 2.6.18-92.el5
- Intel Xeon 2.66 GHz CPU
- 8 GB of Memory
- Java SE Runtime Environment (build 1.6.0.10-rc-b28)
- GCC Version 4.1.2 20071124 (Red Hat 4.1.2-42)
- Python 2.4.3

### 1.7.2 Operating Environment

Our operating environment is a web based application that is only to be used within the SoS (Siena School of Science) network.

### 1.7.3 Maintenance Environment

The maintenance environment includes all of the hardware and software that is used to modify S.L.I.C.E. both in programming code and in visual appearance. This includes the computers in the Software Engineering Lab (stated above) and the software Adobe Dreamweaver, Adobe Fireworks, Adobe Photoshop, Internet Explorer, Mozilla Firefox, Google Chrome, Safari, etc ...

## 1.8 Solution Strategy

- Software Plan
  - The software plan will combine all expectations of the project and briefly describe how the expectations will be reached.
- Requirements Specification
  - This includes all of the detailed needs of the client will be consolidated and outlined.
- Preliminary Design
  - The plan for the development of the base version of S.L.I.C.E. will be created.
- Detailed Design
  - The previous plan for developing S.L.I.C.E. will be review and changed to create the most efficient and cost effective plan.
- Acceptance Test
  - S.L.I.C.E. will be tested by running test programming contests and its efficiency and ease of use will be examined.

## 1.9 Priorities of Features

The focus of S.L.I.C.E. is to integrate all aspects of the current programming contest submission and scoring system. In addition, this integration will significantly increase the efficiency and ease of access for both the contestants and the judges.

## 1.10 Acceptance Criteria

S.L.I.C.E. must comply with all criteria specified by the client, Dr. Darren Lim. In addition, it must meet the expectations of Dr. Lederman the Associate Professor teaching the Software Engineering course at Siena College.

# Chapter 2

## Project Plan

### 2.1 Project Management & Development Model

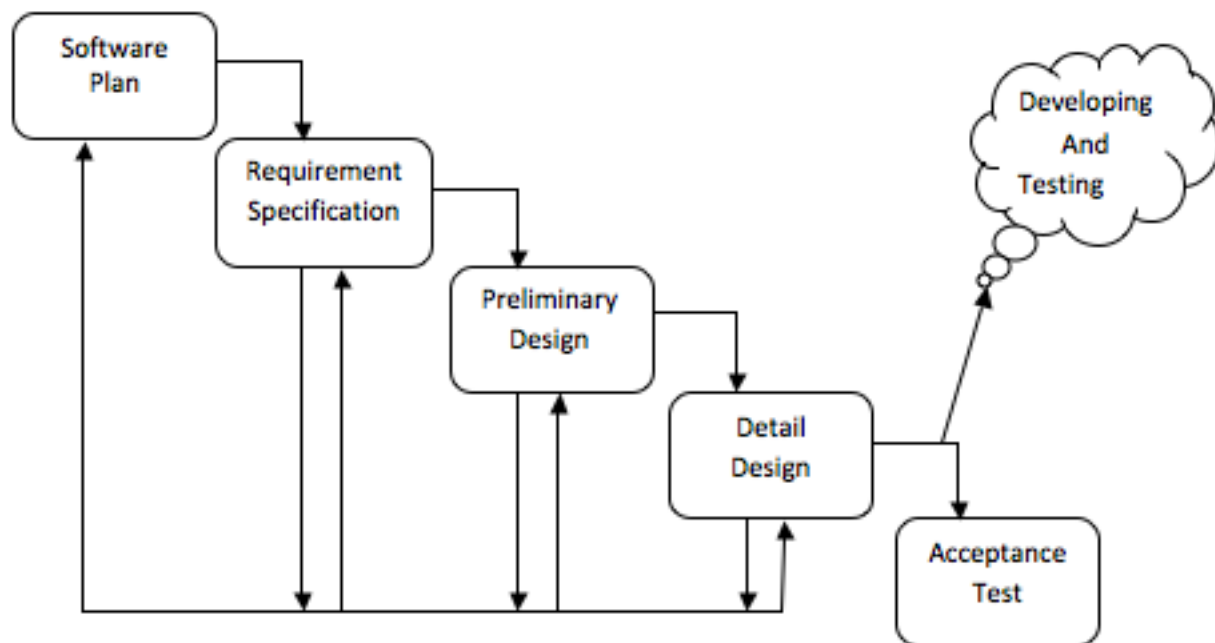


Figure 2.1: The Waterfall Model or the Classic waterfall model is a linear sequential model. The purpose is to help in the organization of the software engineering projects. Thus the waterfall model maintains that one should move to a phase only when its preceding phase is completed and perfected.



- **Software Plan** The Team will examine and determine the problem. Once the team has the Project Plan they will discuss a course of action on how to solve the problem
- **Requirement Specification** After a few team meeting and more importantly client meetings, the team will go into more in-depth specifications about how to solve the problem.
- **Preliminary Design** Once the team has the specifications they can begin to create an outline project design
- **Detail Design** The Preliminary Design will now be improved upon as well as coding will begin to take place. This will be executed in the Spring Semester of 2012.
- **Developing and Testing** Coming down to the end of the project, the team will be regularly be developing and testing S.L.I.C.E.
- **Acceptance Test** The final project is completed and tested. Again, this is the final stage so will be happening at the end of the Spring Semester of 2012.

## 2.2 Team Structure



Zachary Fitzsimmons	zm19fitz@siena.edu	Team Leader
Michael Pepe	mr09pepe@siena.edu	Lieutenant
Anthony Parente	aj20pare@siena.edu	System Administrator
Matthew Ferritto	ma09ferr@siena.edu	Lead Webmaster
Renee Solheim	rm22solh@siena.edu	Document Analyst

- **Team Leader**  
The Team Leaders main responsibility is to organize and manage client and team meetings. The Team Leader is there to make sure everyone work is divided up and everyone is on task. In addition, the Team Leader must communicate with the client and team to ensure that everyone knows what is going on and that the required deadlines are met. The Team Leader also needs to make sure that, as a team, we are satisfying the clients needs. The Team Leader is the tie-breaker in all democratic decisions made by the team.
- **Lieutenant**  
The Lieutenant works closely with the Team Leader, as they must assume the responsibilities of the Team Leader when the leader is not present. The other team members will be able to look to the lieutenant for any questions as well as the Team leader.

- **System Administrator**

Installs and updates all hardware and software needed for the development environment. They are required to know what software and hardware we currently have and will be using, as well as what extra measures the team needs to obtain additional software.

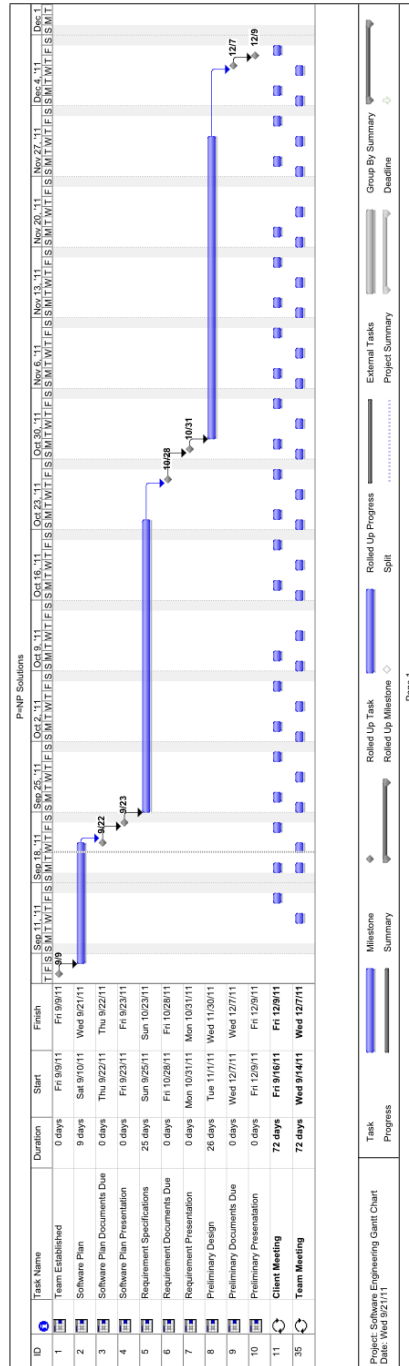
- **Webmaster**

The Lead Webmaster will develop the web-based environment for the project to be used on. The Lead Webmaster will ensure the user-space fulfills clients needs and expectations. In addition, the Lead Webmaster will be responsible for  $P = NP_{solutions}$  team website by keeping the website up to date allowing the team to be well-organized and cognizant of upcoming dates as well as where all of the documents and team information will be hosted.

- **Document Analyst**

The Document Analyst is tasked with reviewing all of the paperwork that is handed in. The structure and look of Powerpoint presentations, notes and any form of document is up to the Document Analyst. The Document Analyst must be attentive and know what is happening in meetings in order to make sure that the team remains organized and well-informed.

## 2.3 Development Schedule Time-Line (Gantt Chart)



## 2.4 Project Monitoring Mechanisms

In order to properly communicate with our client,  $P = NP_{solutions}$  will meet with Dr. Lim twice a week. In addition, team meetings will be conducted at a minimum of twice a week, where the results of the client meetings will be analyzed and implemented. Team meetings also will serve as a focus for preparing for presentation dates, delivery dates, and any other goals set by the team and/or client. Email will be particularly utilized to keep all parties informed and up to date.

## 2.5 Tools and Management

$P = NP_{solutions}$  will use techniques that have been acquired over the past several years in order to successfully complete the project. These techniques were acquired through computer science classes, and in particular through software engineering. Tools may include, but are not limited to: the Apache HTTP Server, Linux, Oracle, Mozilla Firefox 6.0.2, Internet Explorer 9.0, Adobe Dreamweaver, and the Microsoft Office 2007. The Software Engineering Lab will also be utilized for this project as well.

## 2.6 Programming Languages

P=NP Solutions will utilize multiple programming languages, including XHTML, PHP, CSS, MySQL, Java, and AJAX. If the need arises, other programming languages such as JavaScript, Python, or RUBY will be employed as well.

## 2.7 Testing Requirements

The solution developed by  $P = NP_{solutions}$  will be thoroughly tested throughout the development process. In addition, testing will also be conducted during the acceptance test phase in order to ensure that both the team and the client are properly satisfied with the solution. This guarantees that all of the requirements put forth by Dr. Lim are being met. The results of the tests will be documented and uploaded to our team website.

## 2.8 Supporting Documents

Dr. Darren Lim will be receiving multiple supporting documents at various times throughout the development process. The submitting of these documents will keep the client up to date. The supporting documents are as follows:

- Software Plan
  - Requirement Specification
- Preliminary Design
- Detailed Design\*
- Acceptance Test\*

\*Spring 2011

## 2.9 Time of Delivery

The supporting documents will be delivered to Dr. Darren Lim on the following dates:

- Software Plan- September 22, 2011
- Requirement Specification-October 28, 2011
- Preliminary Design-December 6, 2011

The Detail Design and Acceptance Test will be delivered sometime during the Spring 2011 semester. The specific dates have yet to be established but will be determined as soon as possible.

## 2.10 Manner of Demonstration

P=NP Solutions will be giving a presentation on the following Dates:

- Software Plan- September 23, 2011
- Requirement Specification-October 31, 2011
- Preliminary Design-December 7, 2011

As stated above, the Detail Design and Acceptance Test will be delivered and presented to the client at a date in Spring 2011.

## 2.11 Sources of Information

Information will be acquired mostly from Darren Lim throughout the course of the year. The information will be obtained via client meetings that will take place twice a week.

$P = NP_{solutions}$  will use this information in order to meet the goals of the client.

Information also will be obtained from an outside source, Dr. Eric Breimer, who has been a judge in the programming contest.

# Appendix A

## Team Resumes

- Zachary Fitzsimmons
- Michael Pepe
- Anthony Parente
- Matthew Ferritto
- Renee Solheim

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# ZACHARY M. FITZSIMMONS

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51 Skyview Drive, Poughkeepsie NY, 12603  
(914) 489 - 1945 – zm19fitz@siena.edu

## OBJECTIVE

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Complete my undergraduate degrees in mathematics and computer science while immersing myself in diverse work in these fields. I am very interested in working in the field of software development in an introductory position.

## EDUCATION

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**Siena College** Loudonville, NY • B.S. in Comp. Sci and B.S. in Mathematics – May 2012 – GPA: 3.71/4.00

### • Selected Coursework

**Computer Science** Software Engineering, Data Structures, Object Oriented Programming, Bioinformatics, Assembly Language/Computer Architecture, Database Management, Algorithms

## SOFTWARE EXPERIENCE

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- Proficiency in Development in Java, Python, SQL, MATLAB, L<sup>A</sup>T<sub>E</sub>X, Perl, Objective-C (iOS)
- Familiarity with Regular Expressions, UML, UNIX, GNU/Linux, Mac, and Windows, Image Processing

## WORK HISTORY

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**ISTI – Saratoga, NY** -----September 2011 – Present

### *Software Development Intern*

- Worked on projects contracted from my previous work as Siena College Space Sciences
- Coordinated a migration to an off-site server and carried out quality control on solutions deployed from ISTI

**Siena College – Office of Residential Life – Loudonville, NY** -----May 2010 – Present

### *Mentor Resident Assistant*

- Served as the student-head of the SYE (Second-Year Experience) Programming Committee for Siena College
- Organized programs to meet the needs of a Sophomore floor of 44 residents
- Served as a resource for the other 11 Resident Assistants in my building

**Siena College – Space Sciences – Loudonville, NY** -----May 2010 – August 2011

### *Software Developer*

- Designed my own filtering algorithm as a backbone to an iPhone app to display South Pole Aurora Data
- Presented work as a poster at the December 2010 AGU (American Geophysical Union) Conference

**University of New Orleans – New Orleans, LA** -----May 2011 – July 2011

### *Research Scientist*

- Designed algorithms for image processing using steerable filters on FPGAs for fast embedded computing
- Researched as part of the NSF – REU program (Research Experiences for Undergraduates)
- Received best presentation during the final presentation at the REU

**Siena College – School of Science – Loudonville, NY** -----Summer of 2009

### *Summer Scholars Researcher for the Netflix Prize Project*

- Implemented a variety of collaborative filtering algorithms using Java and Oracle
- Presented research at a department colloquium in November 2009

## UNDERGRADUATE RESEARCH

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**Machine Learning Tools in Implicit Association Tests with Dr. Eric Briemer** -----Sept. 2011 – Present

- Applied a diverse array of machine learning tools to IAT data
- Sought to identify “cheaters” in the dataset

**Algorithms on Modular Robots with Dr. Robin Flatland** -----June 2010 - May 2011

- Completed work of collective construction algorithms using swarm robots
- Published in the American Journal of Undergraduate Research (AJUR) – Sept. 2011

**Algorithmic Simulations on Blackjack with Dr. Darren Lim** -----Jan. 2010 - May 2010

- Wrote an extendable blackjack simulator in Java which compared a variety of blackjack strategies
- Presented a poster, *Interactive Blackjack Simulation*, at the Siena College Academic Celebration that Spring

## AWARDS & ACTIVITIES

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- Member of Pi Mu Epsilon Mathematics Honor Society:-----March 2011 – Present
- Member of Upsilon Pi Epsilon Computer Science Honor Society:-----March 2011 – Present
- Practitioner of Wing Chun Kung Fu – Ip Ching Lineage:-----Fall 2009 – Present
- Received 1<sup>st</sup> Place on Siena College’s team in the CCSCNE Computer Programming Contest:----Spring 2011
- Siena College’s D1 Varsity Men’s Cross Country and Track: -----Fall 2008 – Spring 2010
- Member of Siena Colleges Student Athlete Advisory Council:-----Fall 2009 – Spring 2010
- Leo Dufort Student-Athlete of the Month:-----September 2009
- Member of Siena College’s Resident Assistant Council:-----Fall 2010 – May 2011



249 Pruyn Hill Road, Mechanicville NY 12118 • 518-598-4138 • mr09pepe@siena.edu

## Michael R. Pepe

### Objective

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To obtain a Job in the field of Computer Science with an applied focus on Business

### Experience

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#### Web Design Intern- *NYS Police*

Summer 2011 Albany, NY

- Updated various pages daily on the NYSP Intranet
- Implemented JQuery techniques using JavaScript
- Used ColdFusion to take information from a web page and write it to a database
- Used ColdFusion to take information from data base and write it on a web page
- Ensured web pages conformed to standards using Total Validator Tool

#### Assistant to Manager- *Under 6000 Auto Sales*

2006-2010 Troy, NY

- Database entry using Oracle
- Manage Front Desk Sales

### Relevant Research

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#### Co-Author- *Using Point of Sale (POS) Data to Deliver Customer Value in the Supermarket Industry through Category Management Practices*

- Presented at Siena College School of Business Conference, April 8, 2011
- Presented at MBAA International Conference in Chicago, March 25, 2011

### Education

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Siena College

Loudonville, NY

**B.S. Computer Science**-May 2012

**B.S. Business Management**-May 2012

### Skills

- Proficient in Microsoft Word, Excel, PowerPoint
- Web Tools: Dreamweaver, HTML, Cold Fusion, jQuery, JavaScript
- Oracle Database design and entry
- Object-Oriented Design using Blue Jay
- Proficient in Finance and Accounting Principles

**Anthony Parente**

112 Tanglewood Rd. Preston Hollow, New York 12469  
 Cell: 518-810-2489

Siena College, McClosky Square  
 Email: aj20pare@siena.edu

**EDUCATION**

- Siena College, Loudonville, New York **Fall 2008 – Present**
- Major: Computer Science Honors: Presidential Scholar
- GPA: 3.2 Bernard F. Picotte Scholarship

**WORK EXPERIENCE**

***IT Internship, Federal Highway Administration, New York State Division, Albany, NY*** **June 2011 - Present**

- Tier II Support
- Work with team to complete agency tasks
- Technology Support Includes: Windows 7 computer migrations, database upkeep, website design, server backups/restores, and computer troubleshooting.

***ITS School of Science Helpdesk Student Manager – Tier II, Siena College, New York*** **August 2011 - Present**

- Manage a team of four other students
- Find solutions as an individual and as a team to resolve all issues within the SoS Network
- Managerial Duties include: holding team meetings, training consultants, updating team wiki, and maintaining a constant and supportive presence at the helpdesk and SoS as a whole

***ITS Consultant – Tier I, Siena College, New York*** **May 2010 – August 2011**

- Troubleshoot technology problems for both staff and student computers
- Enter work orders through TrackIt and Jira
- Assist technicians with computer installations
- Re-image computer hard drives
- Virus Removal

***Database Administrator for Siena Biology Department, Siena College, New York*** **February 2011 – Present**

- Create database with SQL
- Design database to store student information and mitochondrial DNA sequences
- In the process of transferring the database to Microsoft Access and creating a GUI

***Resident Assistant, Siena College, New York*** **August 2009 – Present**

- Counsel residents and aid in their academic, social, and personal identity development
- Plan and implement programs to promote hall unity and active engagement in the community
- Fairly and consistently address violations of the student code of conduct

**COMPUTER SOFTWARE AND LANGUAGE SKILLS**

- Microsoft Word, PowerPoint, Excel, Access, Outlook, and Adobe Photoshop
- Moderate Experience with Java (BlueJ – Java IDE)
- Moderate Experience with Virus Removal Techniques
- Languages Basics of SQL, Visual Basic, C++, HTML, CSS

**ACTIVITIES AND SERVICE**

- ACM (Association for Computer Machinery) – Communications Officer **September 2010 - Present**
- Italian Culture and Language Club – Vice President **May 2010 - Present**
- Siena Annual Campus Clean Up Day

**Matt Ferritto**

Address: 1210 Spring Avenue - Wynantskill, NY 12198  
 Cell Phone: 518-275-3021  
 Email: ma09ferr@siena.edu

**Education**

Siena College, Loudonville, NY  
 B.S., Computer Science, May 2012  
 Overall GPA: 3.40  
 Minor: Mathematics and History  
 Dean's List, Fall 2010 – Spring 2011  
 Ursula M. Forth Memorial Scholarship, 2008 - Present  
 Presidential Scholarship, 2008 – Present

**Computer Skills**

- Languages: Proficient with Java, familiar with C
- Operating Systems: Windows, Linux (Ubuntu), Mac
- Database Systems: Oracle, MySQL
- Web Development: Proficient with (X)HTML, CSS, familiar with PHP
- Microsoft Suite: Word, PowerPoint, Outlook, Excel
- Adobe Suite: Dreamweaver, Fireworks

**Relevant Experience**

Web Design Intern at SKS Sept. 2011 – Present  
 SKS Bottle & Packaging, Inc., Watervliet, NY

- Created a user-friendly and robust web-based entry form to enter marketing info to track and graph product line success and activity

Webmaster, Software Engineering Sept. 2011 – Present  
 Siena College, Loudonville, NY

- Member of a team that built an integrated system for a programming contest
- Designed and coded the team website

**Additional Experience**

Work-Study Employee Oct. 2009 – Present  
 Siena College Postal Services, Siena College, Loudonville, NY

- Interacted with students and faculty/staff on a daily basis, assisting with any problems
- Directed/participated in mail deliveries around campus several times a day
- Organized packages and letters for student pickup and for faculty/staff deliver
- Coordinated extensively with other offices on campus to meet their needs

Family Business Employee Jan. 2003 – Sept. 2011  
 Geno's Italian Sausage Co., Inc., Watervliet, NY

- Charged with sanitary procedures, required cooperation between workers
- Delivered orders to nearly 25 supermarket stores around the Capital Region
- Provided assistance to owner in processing orders, creating bills, and preparing deliveries

**Computer Science Courses**

- Assembly Language and Computer Architecture
- Object Oriented Design and Programming
- Data Base Management
- Intro. to Artificial Intelligence
- Web Application Development

## Renee M. Solheim

Temporary 515 Loudon Road Loudonville, NY 12211 SPOB 2792  
 Permanent 11 Harvest Common Road Sandy Hook, CT 06482  
 rm22solh@siena.edu | 203-240-7485

### EDUCATION

**Siena College, Latham, NY** Spring 2009- Present  
*Bachelor of Science*  
*Double Major: Mathematics and Computer Science, May 2012 – current* GPA 3.14/4.0  
**Presidential Scholarship** – awarded yearly  
**Awarded The Grace Hopper Celebration of Women in Computing 2011 Scholarship-** Attend Conference In November 2011  
**Skills:** Proficient in MS PowerPoint, MS Word, MS Excel, MS Publisher  
 Java, BlueJ, Visual Basics, Visual Basics, LaTeX, Linux, MATLAB, Mathematica  
 Adobe, PageMaker

### RELEVANT EXPERIENCE

**MOVETHATBLOCK.COM, Web Developer – Latham, NY** September 2011 - Present  

- Developed the website for the new incubator website MoveThatBlock.com.
- Used Ruby on Rails to solve problems and bugs within website.

**WEB DEVELOPMENT & DATABASE DESIGN, USING RUBY ON RAILS** September 2011 - Present  
*Independent Study with Dr. Darren Lim - Siena College, Latham, NY*  

- Independently learned Ruby on Rails with the assistant of Dr. Lim.
- Developed a website using Ruby on Rails with CSS.
- Presented the Website to professors and guests in a Spring 2011 Computer Science talk.

**SOFTWARE ENGINEERING, Document Analyst – Latham, NY** September 2011- Present  

- Worked directly with a Client on a team of five to unravel and solve a problem.
- Oversaw every document that was handed in, presented or edited on our website.
- Joined forces with the all five team members in the creation of our team website and program website.

**SPECIAL OLYMPICS NEW YORK, Public Relations – Schenectady, NY** Summer 2011  

- Managed the social network social media sites, Facebook, Youtube and Twitter.
- Designed and compiled the brochure for fundraising events using PageMaker.
- Collaborated with employees on enhancements to past and current events.

### ADDITIONAL EXPERIENCE

**SIENA COLLEGE, Chair, Public Relations – Student Events Board – Latham, NY** Sep. 2010- Dec. 2010  

- Formulated advertisements for the campus wide weekly events

**CAMP HORIZONS, Program Instructor – South Windham, CT** Summer 2010  

- Constructed Activities, Movements and Dance weekly lesson plans for the developmentally and mentally disabled campers.

**SIENA COLLEGE, S.A.I.N.T.S, Orientation Leader – Latham, NY** Summer 2010  

- Advised freshman through the transition from high school to college

### SKILLS & ACTIVITIES

• Sodexo Catering September 2009- Present  
 • Siena College, Siena College, Siena College

# Appendix B

## Glossary of Terms

- Adobe Dreamweaver – a web-development Integrated Development Environment
- Adobe Fireworks – a vector graphics editor
- Adobe Photoshop – a professional graphics editor
- AJAX – asynchronous JavaScript and XML
- Apache – an open source web sever
- Apple Safari – a web-browser development by Apple
- CentOS – a distribution of Linux based off of Red Hat Linux
- CSS – Cascading Style Sheets for organizing the look and feel of webpages
- Gecko – a web-browser framework
- Google Chrome – a web-browser developed by Google using WebKit
- IDE – Integrated Development Environment
- Java – a cross-platform object oriented programming language
- JavaScript – a weakly-typed dynamic scripting language
- Linux – a computer operating system developed as open source software
- Microsoft Internet Explorer – a web-browser developed by Microsoft
- Microsoft Office 2007 – Office tools provided by Microsoft
- Mozilla Firefox – a web-browser developed with the Gecko engine
- MySQL – an open source Relational Database Management System
- PHP – a scripting language often used in web applications

- Python – a scripting language
- Relational Database Management System – data is stored on tables with relations defining them
- SQL – Secure Query Language
- Ruby – an object oriented scripting language
- WebKit – a web-browser framework
- XHTML – eXtended Hyper Text Markup Language
- XML – eXtended Markup Language