New Mexico Adventures in Supercomputing Challenge 2002

Summer Teacher Institute (STI)
San Juan College
June 3 – 14, 2002

Combined Syllabus and Schedule

Mission Statement

The mission of New Mexico Adventures in Supercomputing Challenge is to improve students' understanding and use of technology by developing their skills in scientific inquiry, modeling, computing, communication, and teamwork.

Summer Teacher Institute Description

The Summer Teacher Institute (STI) is a two-week institute for teachers sponsored by NASA AMES in conjunction with San Juan College, LANL/DOE, DARPA and New Mexico Technet. Acquiring skills to support computational science for mid and high school students is the overarching goal of STI. Topics will include problem solving, science, math modeling, technology, programming, research, working with mentors, project management, time management, team management, presentations, gender equity, computer ethics and technical writing.

Goal of STI

Teachers will learn how to sponsor a New Mexico Adventures in Supercomputing Challenge team and how to help students complete an appropriate computational science project in keeping with the AiS Challenge mission statement.

The computational project incorporates four components: Project Management, Structured Programming and Design, Math Modeling, and Internet Resources:

1. Project Development

The creation and maintenance of a year long project involves many responsibilities: topic selection, creating a problem definition, topic research, meeting deadlines, providing motivation, obtaining a mentor, ethical behavior, technical reports, oral and computer presentations, team development, time management, online responses, etc. Tips for planning this yearlong commitment will be shared!

2. Structured Programming and Design

A. HTML - The hypertext markup language (HTML) is the standard language for the World Wide Web. A markup language is a way of describing, using instructions embedded within a document, what the document text means, or what it is supposed to look like. Simply, it is a collection of tags used to mark blocks of text and assign them special meaning. An HTML tag is set off by angle brackets <tag and the code is placed within these brackets. Most tags come in pairs, with the tags placed before (and often after) the affected text.

The sections on HTML in the Adventures in Supercomputing Challenge Summer Teacher Institute are centralized in five basic areas: planning, research, development, refinement and implementation. These five areas work as organizational frameworks for instruction and learning, progress and presentation. This approach allows for a deeper search into a topic and frames

the use of computer technology tools with a specific purpose. The goal is to embed the use of the educational technology within a task of developing a Web Site using HTML and the tools of the Internet.

By the end of the instruction in HTML, students should understand how to:

- Plan and lay out a Web site using appropriate software
- Work with the preferences and options of the Browser
- Create Web pages using basic HTML structure
- Add and alter text and lists
- Create links (relative, document relative, absolute)
- Define tags and use the Attribute = "Value" Relationship
- Place ownership on pages
- Create basic tables for data usage and layout
- Publish a Web site on the Internet using FTP

B. Introduction to Computer Programming -- Unix

The goal of the Unix lecture/lab time is to get the student comfortable with several Unix commands that will allow them to manipulate files and directories in support of the programming and HTML modules.

Students will learn how to create and remove files, create organized folders (directories) of files, and see what files exist. They will learn to use editors to create and modify files.

They will also practice using a web based electronic mail client that will be used by all the students in the upcoming AiS Challenge year.

C. Introduction to Computer Programming -- Java

Computer programming is the process of planning and creating a sequence of steps for a computer to follow. In general, this process will help us resolve a problem, which is either too tedious or difficult to work out otherwise. In this class we will utilize the Java programming language, on PCs running the Windows operating system, to implement the actual steps.

Java is a full-featured programming language similar in functionality to C++ and other “high-level” languages. Once heralded as “the next-best thing” for the web, Java is now regarded as an exceptional language for creating stand-alone applications. This is in no small part due to the relative ease with which Java can create a GUI (Graphical User Interface).

Many Colleges and Universities now teach Java in “Computer Programming 101”. The High School AP (Advanced Placement) test in computer science will also be based on Java starting in 2003.

D. Introduction to the Message Passing Interface -- MPI

This class is designed for those with absolutely no MPI programming experience. An overview of parallel programming concepts, basic MPI functions, and simple communication techniques will be covered. Proficiency programming in C, C++, or Fortran, as well as experience using a Unix based operating system will be assumed of all participants who wish to take this particular class.

Parallel programming is essentially multiple operations, occurring simultaneously, working cooperatively to solve a computational problem. The programming is usually executed on a parallel computer, or "supercomputer" -- a collection of processors interconnected in a certain fashion as to allow coordination of work and exchange of data. The AiS Challenge has access to various supercomputers through Los Alamos National Laboratory.

3. Math Modeling

Mathematical modeling is the process of creating a mathematical representation of some phenomenon in order to gain a better understanding of it; mathematical modeling is an integral component of the computational science project. During the process of building a mathematical model, the modeler must decide what factors are relevant to the problem and what factors can be de-emphasized. Once a model has been developed and used to answer questions, it should be critically examined and often modified to obtain a more accurate reflection of the phenomenon. In this way, mathematical modeling is an evolving process; as new insight is gained, the process begins again as additional factors are considered. "Generally the success of a model depends on how easily it can be used and how accurately it predicts.

The mathematical modeling/computational science module will include an overview of the role of mathematical modeling in the computational science project, modeling sites and resources, some examples of models (compartmental models, population models, epidemic models, one- and two-dimensional heat flow models, etc.), and an introduction to some basic numerical methods (Gaussian elimination and iteration). Examples will be implemented in Excel, but can be programmed in JAVA or any other procedural computer language.

4. Internet Resources

The AiS Challenge website, http://challenge.nm.org, will link to all important resources: Technical Guide, teacher resources on gender equity, ethics, computational science, mentors, research, presentations, technical writing, grants, programming, etc. Links to science, math, technology and computational science standards and ways to integrate technology into the curriculum will be utilized. These sites will be shared throughout the two weeks.

Course Requirements

Students will attend two full weeks of classes, 90 hours, covering core components of computational science: project development, programming, math modeling, and Internet resources.

Students will

- participate in a creating a team supercomputing computational project.
- present the project to a team of judges.
- take pre-test and post-tests to show progress.
- learn about the 2002-03 Challenge timetable, milestones and expectations.
- learn programming skills, HTML, JAVA programming, MPI programming
- learn math modeling and computational techniques, project management tips, and research aides.

Credit

Attendees will receive three units of graduate credit from New Mexico Institute of Mining and Technology as course MST 589-03 "Supercomputing Challenge Trng", course reference number 11683.

Grading

Grading will be pass/fail. If a student fulfills the attendance, project, presentation, and assessment requirements, s(he) will pass.

Room, Board, and Stipends

Participants will receive $350 on June 2nd for meals. Lodging in the Comfort Inn is provided by STI. A stipend of $500 will be awarded on June 14th.

Textbooks and Software (Provided for Students)

Deitel and Deitel. *C++ How to Program, 3rd Edition.* ISBN 0-13-089571-7.
Deitel & Deitel. *Java How to Program (Fourth Edition*) ISBN 0-13-034151-7
Graham, Ian S. *HTML 4.0 Sourcebook*. ISBN 0-471-25724-9
Inspiration Software. http://www.inspiration.com. Silicon Heights Computers. 1-800-654-6623.

Instructors

Richard Allen, UNM, rcallen@unm.edu
Celia Einhorn, New Mexico Technet, celia@nm.net
Gina Fisk, LANL/DOE, gina@lanl.gov
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Bill Robertson, LANL/DOE, robertson@lanl.gov
Willard Smith, NASA AMES, TN State, smith@coe.tsuniv.edu

Schedule

Sunday, June 2nd

3:00 Motel Check In

4:45 In rooms 1008/1010 of the Student Union Building (Sub) at San Juan College. Registration and Material Distribution (Binder with syllabus, books, software, name tag, and food stipend)

Welcome (Ann Degner, Assistant Vice President for Distance Learning, San Juan College)

*Introductions *Pre-Test *Project Management and Team Time *Dinner Buffet

AiS (Adventures in Supercomputing) Challenge Summer Teacher Institute - 2002

Monday June 3rd	4th Kickoff	5th Abstract Due	6th	7th Interim Due
8 - Java and Juice - AiS Challenge Intro	8 - Java and Juice - Open Lab	8- Java and Juice - Open Lab	8 - Java and Juice - Open Lab	8 - Java and Juice - Open Lab
8:30 Welcome from Dr. James C. Henderson, President, SJC; NASA Keynote, Dr. Willard Smith, Professor, TN State, NASA Ames	Project Management and Team Time; Exploring Minds (EM) TEAF&	Teamwork Presentation	Project Management and Team Time; EM	Project Management and Team Time; EM
9:30 - Coffee and Collaboration	Coffee and Collaboration	Coffee and Collaboration	Coffee and Collaboration	Coffee and Collaboration
9:45 – Overview AiS Challenge Web page	Computational Science and Math Modeling	Successful Projects and Student Team Presentation	Computational Science and Math Modeling	Computational Science and Math Modeling
Lunch	Lunch	Lunch	Lunch	Lunch
1 – HTML; MPI	HTML; MPI	HTML; MPI	MPI	SP & D Java, C++
3 - Cookies and Comfort	Cookies and Comfort	Cookies and Comfort	Cookies and Comfort	Cookies and Comfort
3:15 SP & D* Programming	SP & D	SP & D	SP & D	Presentation Presentation
4 - Computational Science and Math Modeling	Research	Challenge Year Review Complete Abstracts	Team Time Finish Interims	
Evaluation	Evaluation	Evaluation	Evaluation	Evaluation

* Structured Programming and Design
& Team Entry Authorization Form
EM –Your Exploring Minds, TN State program

AiS (Adventures in Supercomputing) Challenge Summer Teacher Institute - 2002

Monday June 10th – Interim Judging	11th	12th	13th Final Report Due	14th Final Judging – Award Expo
8 – Java and Juice - Open Lab	8 – Java and Juice - Open Lab	8 – Java and Juice - Open Lab	8 – Java and Juice - Open Lab	8 – Java and Juice - Open Lab
8:30 - Project Management and Team Time; Security: Research	Here Comes the Judge; Project Management and Team Time	Project Management and Team Time	Project Management and Team Time	Project Management and Team Time
9:30 - Coffee and Collaboration	Coffee and Collaboration	Coffee and Collaboration	Coffee and Collaboration	Coffee and Collaboration
9:45 – Team Time	Math Modeling	Team Time	Team Time	Final Oral Evaluations
Lunch	Lunch	Lunch	Lunch	Lunch
1 SP & D* Programming	SP & D	SP & D	SP & D	Awards
3 - Cookies and Comfort	Cookies and Comfort	Cookies and Comfort	Cookies and Comfort	
3:15 Team Time	Team Time	Team Time	Team Time	
4 – Interim Judging	Gender Equity	Technical Writing; Mentors	Computer Ethics + MP3; Siemens Westinghouse Contest	
Evaluation	Evaluation	Evaluation	Evaluation 6:30 Banquet Speaker	Post Test; Final Evaluation

* Structured Programming and Design

Free Resources

Hands On! Newsletter on math and science learning – TERC – http://www.terc.edu

Teaching Tolerance Magazine from the Southern Poverty Law Center – http://teachingtolerance.org

T.H.E Journal (Technological Horizons in Education) – Professional Development, Distance Learning, Curriculum - http://www.thejournal.com

The Magazine of Design & Technology Education, ties – Resources, Multimedia, Literature – good ideas for projects – http://www.tcnj.edu/~ties

Web Resources

Bad Science
http://www.ems.psu.edu/~fraser/BadScience.html

Challenge Acceptable Use Policy
http://www.challenge.nm.org/Glorieta/aup.shtml

Explorers of the Universe
http://explorers.tsuniv.edu/

Good Projects –

- Computer Modeling of Cultural Interaction and Evolution

http://www.challenge.nm.org/FinalReports/090.pdf

- Tales from the Encrypt

http://www.challenge.nm.org/FinalReports/050.pdf

- Modeling the Spread of West Nile Virus

http://www.challenge.nm.org/FinalReports/019.pdf

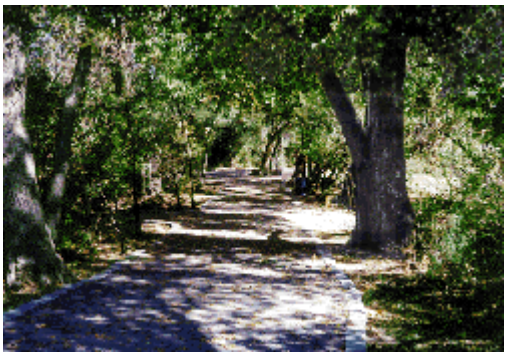
- The Winning Hand

http://www.challenge.nm.org/FinalReports/045.pdf

How to Think
http://www.challenge.nm.org/archive/00-01/Regionals/howtothink.html

Mathematical Models
http://www.krellinst.org/AiS/textbook/unit2/projdev2.3.5.html

Model of Modeling
http://www.nsca.uiue.edu/Edu/SuperQuest/sqt/modeling.html



Non-software Teacher Resources to Support Modeling
http://www.ecsu.k12.mn.us/envision/gradrule/additional.html

New Mexico Adventures in Supercomputing Challenge
http://www.challenge.nm.org

Siemens Westinghouse Competition
http://www.siemens-foundation.org/science/science_and_technology.htm

Technical Guide
http://www.challenge.nm.org/ctg/

Writing the Final Report
http://www.challenge.nm.org/FinalReports/writing.shtml

Your Exploring Mind
http://exploringminds.tsuniv.edu/EOM/