Interdisciplinary Computational Graduate Education Program – Spring 2017

Welcome to the first semester of the Interdisciplinary Computational Graduate Education Program, a National Research Training program funded by the National Science Foundation!

The faculty for this project are:
Marjorie Zatz (PI), Juan Meza (Co-PI), Michael Spivey (Co-PI), and Michael Colvin, Sayantani Ghosh, Arnold Kim, Ashlie Martini, Paul Maglio, Suzanne Sindi, and Mukesh Singhal. We can best be reached by email.

Schedule of Activities:

The Interdisciplinary Computational Graduate Education Program will meet every Friday during the spring semester from 2:00-5:00 in COB 322 (Willow Room) for instruction and team work.

Dec 13, 15 – Program Launch

Jan 20 – Instructional modules:
Practices and Habits of Successful Graduate Students in the Interdisciplinary Computational Sciences. *Lead faculty*: Meza and Zatz (30 min) and
Interactive Programming**.** *Lead faculty*: Colvin and Spivey, assisted by Jeffrey Weekley, Director of Cyber Infrastructure and Research Computing (45 min)

Jan 27 - Instructional Modules
Practices and Habits of Successful Graduate Students in the Interdisciplinary Computational Sciences. *Lead faculty*: Meza and Zatz (30 min) and
Interactive Programming**.** *Lead faculty*: Colvin and Spivey, assisted by Jeffrey Weekley, Director of Cyber Infrastructure and Research Computing (45 min)

Feb 3 – Instructional Modules:
Interactive Programming**.** *Lead faculty*: Colvin and Spivey, assisted by Jeffrey Weekley, Director of Cyber Infrastructure and Research Computing (45 min)
and The Linux Operating System and Shell Scripting. *Lead faculty*: Ghosh and Sindi (45 min)

Feb 10 – Instructional Modules:
Interactive Programming**.** *Lead faculty*: Colvin and Spivey, assisted by Jeffrey Weekley, Director of Cyber Infrastructure and Research Computing (45 min)
and The Linux Operating System and Shell Scripting**.** *Lead faculty*: Ghosh and Sindi (45 min)

Feb 17 Instructional modules:
The Linux Operating System and Shell Scripting. *Lead faculty*: Ghosh and Sindi (45 min) and
Team Science and Project Management. *Lead faculty*: Meza and Maglio (30 min)

Feb 24 – Instructional modules:
The Linux Operating System and Shell Scripting. *Lead faculty*: Ghosh and Sindi (45 min) and Team Science and Project Management. *Lead faculty*: Meza and Maglio (30 min)

March 3 – Instructional Modules:
Practices and Habits of Successful Graduate Students in the Interdisciplinary Computational Sciences. *Lead faculty*: Meza and Zatz (30 min) and Team Science and Project Management. *Lead faculty*: Meza and Maglio (30 min)

March 10 – Instructional modules:
Practices and Habits of Successful Graduate Students in the Interdisciplinary Computational Sciences. *Lead faculty*: Meza and Zatz (30 min) and Compiled Programming. *Lead faculty*: Colvin and Kim (45 min)

March 17 – Instructional modules:
Compiled Programming. *Lead faculty*: Colvin and Kim (45 min) and High Performance Clusters and Remote Supercomputers. *Lead faculty*: Martini and Singhal, assisted by Jeffrey Weekley (Director of Cyber Infrastructure and Research Computing) (60 min)

March 24 – Instructional modules:
High Performance Clusters and Remote Supercomputers. *Lead faculty*: Martini and Singhal, assisted by Jeffrey Weekley (Director of Cyber Infrastructure and Research Computing) (60 min) and Team Science and Project Management. *Lead faculty*: Meza and Maglio (30 min)

April 7 – Instructional module:
Compiled Programming. *Lead faculty*: Colvin and Kim (45 min)

April 14 – Instructional module:
Compiled Programming. *Lead faculty*: Colvin and Kim (45 min)

April 21 – Presentation training

April 28 – Presentations by 2 student teams

May 5 – Presentations by 2 student teams

May 12 – Celebration and recognitions

A description of the six instructional modules, including their format, objectives, and anticipated outcomes, follows below:

Module 1: **Practices and Habits of Successful Graduate Students in the Interdisciplinary Computational Sciences.** *Lead faculty*: Meza and Zatz

Format: In addition to the orientation, four 30-minute instructional sessions plus continuous hands-on experience in project teams and at final group presentation.

Objectives: Provide students expectations and goals for graduate school and beyond. *Student Learning Objectives*: 1 (Professionalization) and 5 (Career Preparation).

Description: This module will provide students the fundamental, non-technical skills needed in graduate school such as clarifying the nature of the Ph.D. and how it differs from undergraduate studies, ethical practices in research, and preparing publications, presentations, webpages, curriculum vitae, etc. through participation in discussions and activities with an inclusive community of scholars. In addition, students will be introduced to the value of interdisciplinary and transdisciplinary research and to the broad spectrum of career opportunities in the computational and data sciences. To hone their oral communication skills, project participants will participate in GradSlam, a UC system-wide competition in which students must present their research in three minutes. Writing skills will be addressed through Dissertation Boot Camp and through the publishing and grant writing workshops offered by the Graduate Division. Students may also participate in our Preparing Future Faculty and Preparing Future Professionals series, which include forums on choosing between academic and nonacademic careers, the postdoctoral research experience, interviewing for academic positions and negotiating the job offer, surviving and thriving as faculty of color, employment opportunities for Ph.D.s in industry, business, government, and nongovernmental organizations, preparing for jobs in industry, and National Labs Day (see http://graduatedivision.ucmerced.edu/GEARS). In addition, UC Merced has a subscription to the National Center for Faculty Development and Diversity and the Versatile Ph.D. and we will draw on webinars and other resources from these clearinghouses.

Outcomes: Upon completing this module, students will have adjusted to graduate school, and will have developed a curriculum vitae, personal webpage, and Independent Development Plan,

Module 2: **Interactive Programming.** *Lead faculty*: Colvin and Spivey, assisted by Jeffrey Weekley, Director of Cyber Infrastructure and Research Computing

Format: Four 45-minute instructional sessions plus continuous hands-on experience in project teams.

Objectives: Provide experience successfully writing, testing, and validating programs in several interactive and scripting programming environments such as Matlab, R, Python, and CalVR. *Student Learning Objectives:* 2 (Team Science), 3 (Research Skills) and 4 (Computational Skills).

Description: This module will teach students fundamentals of programming such as data structures, logical operations, loops, and data management and visualization using interactive programming environments. Data visualization will include virtual immersion demonstrations in our Virtual Reality CAVE (Computer Assisted Virtual Environment), an intracampus facility housed in the Digital Humanities Lab.

Outcomes: Upon completing this module, teams of students will have developed, tested and cross-validated codes in Matlab, R, Python, and CalVR to solve problems relevant to their own research and, in so doing, gained team science skills.

Module 3: **The Linux Operating System and Shell Scripting.** *Lead faculty*: Ghosh and Sindi

Format: Four 45-minute instructional sessions plus continuous hands-on experience in project teams.
Objectives: Provide experience working with the Linux operating system and developing shell scripts. *Student Learning Objectives*: 3 (Research Skills) and 4 (Computational Skills).
Description: This module will teach students how to manage files, transfer data, and execute programs in the Linux operating system.
Outcomes: Upon completing this module, the students will be able to use commands in the Linux operating system to organize and parse data files, to transfer data between computer systems, and write scripts to automate program execution and data analysis.

Module 4: **Compiled Programming.** *Lead faculty*: Colvin and Kim
Format: Four 45-minute instructional sessions plus continuous hands-on experience in project teams.
Objectives: Provide experience successfully writing, testing, and validating programs in several compiled programming languages such as C and C++. *Student Learning Objectives*: 3 (Research Skills) and 4 (Computational Skills).
Description: This module will teach students the translation of prototype codes written in interactive programming languages to compiled programming languages more suitable for large-scale computations.
Outcomes: Upon completing this module, teams of students will have developed, tested and validated codes to solve problems relevant to their own research.

Module 5: **High Performance Clusters and Remote Supercomputers.** *Lead faculty*: Martini and Singhal, assisted by Jeffrey Weekley (Director of Cyber Infrastructure and Research Computing)
Format: Two 60-minute instructional sessions plus continuous hands-on experience in project teams.
Objectives: Provide experience accessing and using high performance clusters and remote supercomputer systems, such as those on the NSF-funded XSEDE network. *Student Learning Objective*: 4 (Computational Skills).
Description: Each student will be provided an account on an XSEDE supercomputer as part of an educational allocation, learn about accessing and using this computer, write scripts to run programs in the supercomputer's queuing system, and run a series of benchmark simulations.
Outcomes Achieved: Upon completing this module, students will be able to effectively use local and remote supercomputing resources for their graduate research.

Module 6. **Team Science and Project Management.** *Lead faculty*: Meza and Maglio
Format: In addition to the orientation, four 30-minute instructional sessions plus continuous hands-on experience in project teams and at final group presentation.
Objectives: Provide experience with managing projects using a team science approach, and provide deep understanding of the technological and social challenges and opportunities associated with team science. *Student Learning Objectives*: 1 (Professionalization) 2 (Team Science), 3 (Research Skills), and 5 (Career Preparation).
Description: In this module, students will learn project management and teamwork skills. The weekly project team activities will teach participants about the technology-based tools that

enable collaboration and project management and how to identify and structure a project, organize the team, break the work into subprojects, and assess team performance. They will learn to identify and address different types of problems and the scientific skills necessary to complete those projects. We will also familiarize students with basic team science tools, skills and principles as well as different frameworks for developing solutions to real-world problems, thus enabling our students to transition from incremental research to transformational breakthroughs. Students will utilize various cloud-based tools and platforms for cooperation and coordination.

Outcomes Achieved: Upon completing this module, students will be able to efficiently and effectively participate in team science projects, and be able to assess and diagnose issues related to team effectiveness and efficiency.

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Interdisciplinary Projects:

Project Name: "Network Analysis of Power Grid Integrity"
Team Name: "Power Rangers"
Team: Jon Anzules (QSB), Ayme Tomson (CIS), Taran Rallings (QSB)
Advisory Board Mentor: Mihai Anitescu (Argonne)
Faculty Mentors: Ashlie Martini, Paul Maglio, Michael Spivey

Project Name: "Optimized Sensor Modeling for Diabetes"
Team Name: "Sense Air"
Team: Amin Boroomand (QSB), Adolfo Ramirez-Aristizabal (CIS), Imtiaz Ali (Physics), Jackie Shay (QSB)
Advisory Board Mentor: Spike Narayan (IBM) and Janice Zdankus (HPE)
Faculty Mentors: Michael Colvin

Project Name: "Cosmological Data Analysis"
Team Name: "Pale Blue Dot"
Team: Jose Zamora (BEST), Alyssa Funk (QSB), Farnaz Golnaraghi (Physics), Thomas Thayer (EECS)
Advisory Board Mentor: David Brown (LBNL)
Faculty Mentors: Arnold Kim, Juan Meza

Project Name: "SADI: Smart Archeology Investigator"
Team Name: "Indiana Drones"
Team: Derek Hollenbeck (ME), Jeramias Gonzalez (Physics), Katherine Shurik (IH)
Advisory Board Mentor: David Berger (NASA)
Faculty Mentors: Mukesh Singhal