

BNL Scientific Computing Seminars for MoMath 2016-2017

Summary

The purpose of these four ½-day workshops is to introduce students to some of the fundamental concepts in Scientific Computing (SciComp). SciComp differs in focus from the traditional topics covered in classical Computer Science (CompSci) courses. SciComp places a greater emphasis on efficient numerical computation, advanced graphical visualization, simulation, and overall algorithmic efficiency.

Students will learn many of the programming techniques used by BNL scientists to analyze large data sets and to verify new theoretical models in biology, chemistry, and physics. A heavy emphasis is placed upon mathematical problem solving. Participants will write their programs in C++ using dedicated virtual machines hosted in Amazon's cloud which the students can access while on site at BNL and from their home. No prior programming experience is required.

The workshop consists of 18 hands-on programming exercises with specific lab versions targeting varying mathematical skill levels. Additional research questions will be answered by the students as part of the exercises for each lab. The goal is to inform STEM students about the critical need to develop strong skills in scientific computing so they may obtain potential future research internship appointments within world-class organizations.

Syllabus

Session #	Date	Time	Topic	Lab Exercises
01	11/19/2016	9:00 - 10:20 am	Programming in the Cloud	Basel Problem, GCD, Coprime Probability
02	11/19/2016	10:30 - 11:50 am	Continued Fractions	Standard & Generalized Continued Fractions
03	12/10/2016	9:00 - 10:20 am	Encoding, Instrumentation, Random Processes	Card Dealer Algorithms
04	12/10/2016	10:30 - 11:50 am	Complex Algebra	Euler's Equation
05	2/11/2016	9:00 - 10:20 am	2D Cartesian and Polar Graphics with Allegro	Draw Parametric Curves, Euler Line
06	2/11/2017	10:30 - 11:50 am	Monte Carlo Integration	QRNGs, Volume of Hyperspheres
07	3/11/2017	9:00 - 10:20 am	Differential Equations, CERN ROOT	Flourine-18 Decay, Carbon Dating
08	3/11/2017	10:30 - 11:50 am	Fourier Analysis	DFT, IDFT, Arecibo Signal Analysis