

# Lecture 1

## Syllabus Overview and Getting to Know You

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## Syllabus overview



# Course overview

## Course content:

This course introduces you to the science of computations. Algorithms for standard problems in computational science are presented. The basics of the object-oriented programming language C++ are taught to facilitate the implementation of algorithms.

## Course objectives:

- Identify the components of scientific computing
- Identify standard problems in scientific computing
- Implement basic algorithms for standard problems in computational science using C++.
- Write, debug, and verify computer programs
- Output results of computer simulations in a meaningful manner



## Grading Policy:

The grading for this course will be based upon participation, weekly homework assignments, and a final project. The weights are given as follows:

- Participation (10%)
- Homework (50%)
- Capstone Project (40%)

## Late Homework Policy:

Late homework will be treated as follows: the maximum achievable grade on a homework assignment will decrease by 10 points for every business day late. After 5 business days or more, the maximum penalty is capped at 50 points. In other words, a student is encouraged to submit any late homework **by December 3rd, 2020** for up to 50 percent credit. Homework submitted after will not be graded.



## Capstone Project:

This course requires a final “capstone project” in order to fulfill FSU’s Computer Competency Requirement. Completion of the project requires a working program demonstrating knowledge of the subject matter taught in the course and a written report (3-5 pages).

Grading of the program submitted is based on the student’s ability to explain the problem and solution, correctness, efficiency, and clarity. In other words, the program must compile and run, must be a correct implementation of a procedure to solve the problem, and must report information about the solution to the problem that can be presented in a table or a plot. The grade percentages for the Capstone project are as follows:

- C++ program (60%)
- written report (30%)
- oral presentation(10%)



# Introductions



## Introductions + BINGO Activity

Let's take some time to get to know each other.

Personal slides

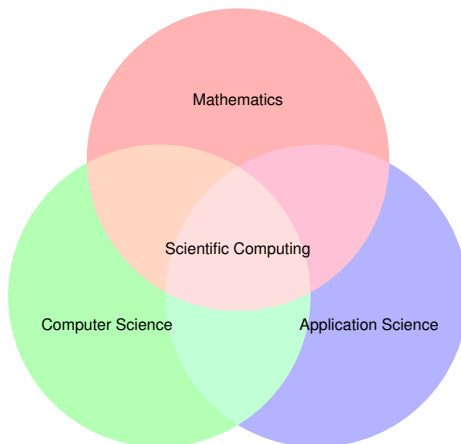


# What is scientific computing?





# An interdisciplinary field



# Problems in Scientific Computing

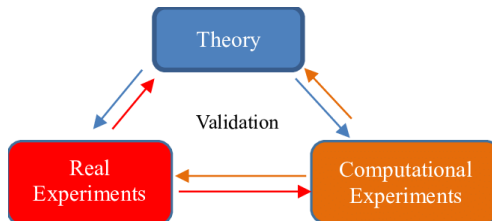
A problem in the field of scientific computing (computational science) typically requires:

- understanding of physical principles
- the development or use of a mathematical model
- the development or implementation of numerical algorithms
- large-scale (parallel) computations
- verification of the code for the problem at hand



# The third pillar of science

Computations have provided a new ability to probe the natural world.



## Overview of computational science topics



# Fundamental numerical math topics

Solutions to these types of problems are essential in computational science:

- linear algebra (solving systems of equations):  $Ax = b$
- solving nonlinear equations: find  $x$  such that  $x = \sin(x)$
- interpolation and fitting of data:  $y = mx + b$
- approximate integrals:  $\int_a^b f(x)dx$
- solving differential equations:  $\frac{dy}{dt} = \exp(-\lambda t)$ ,  $y(0) = y_0$



# Fundamental computer science topics

The following computer science topics are also important:

- object-oriented programming (and debugging!)
- data structures
- parallel computing



# Scientific applications

There are many scientific applications to explore:

- Engineering (solid mechanics, materials science, fluid dynamics, vibration dynamics, ...)
- Biology (computational neuroscience, vesicles, population dynamics, computational genetics,...)
- Machine learning (autonomous navigation, ...)
- Data science (fraud and risk detection, healthcare, internet search, advanced image recognition, ...)

In fact there are too many to list!



## Why be a computational scientist?





# Why be a computational scientist?

Money!



According to Glassdoor.com:

## How much does a Computational Scientist make?

Updated Aug 12, 2021

Industry:  Employer Size:  Experience:

Very High Confidence

**\$103,338** /yr

Average Base Pay

124 salaries



No additional cash compensation has been reported for this role

The national average salary for Computational Scientist is \$103,338 per year in United States. Filter by location to see Computational Scientist salaries in your area. Salaries estimates are based on 124 salaries submitted anonymously to Glassdoor by Computational Scientist employees.

