

# Math 483/583 - High Performance Scientific Computing

Instructor

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Teaching Assistants

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# Overview

- “High Performance Scientific Computing”
- Course goals and syllabus
- Homework, quizzes, and final exam
- This week’s homework
- Demo of SageMathCloud

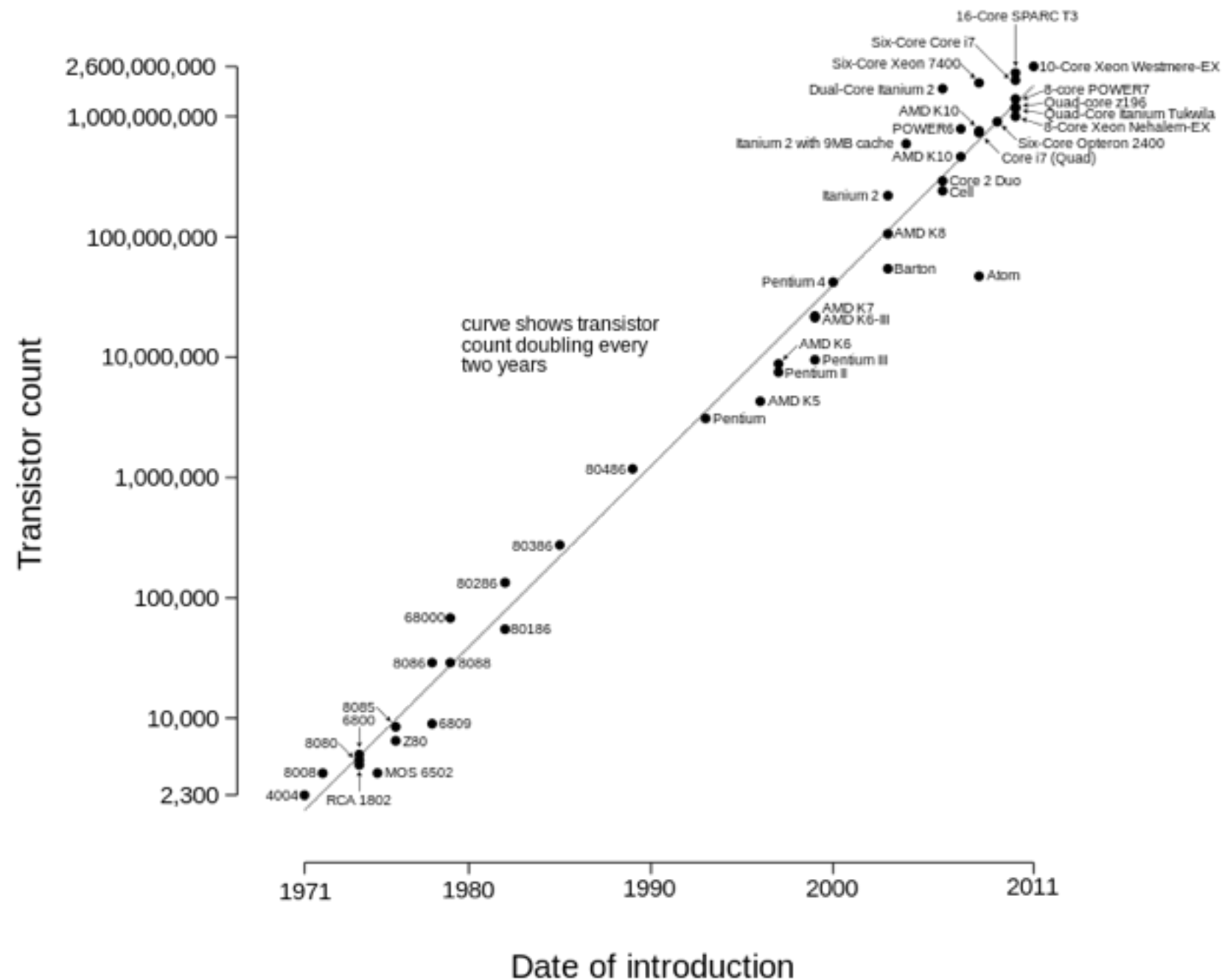
# Course Sections

	In-Class	Online	Online Masters / EDGE
AMath 483	A SLN 10212	B SLN 21245	
AMath 583	A SLN 10230	C SLN 21246	B SLN 10231

# High Performance Scientific Computing

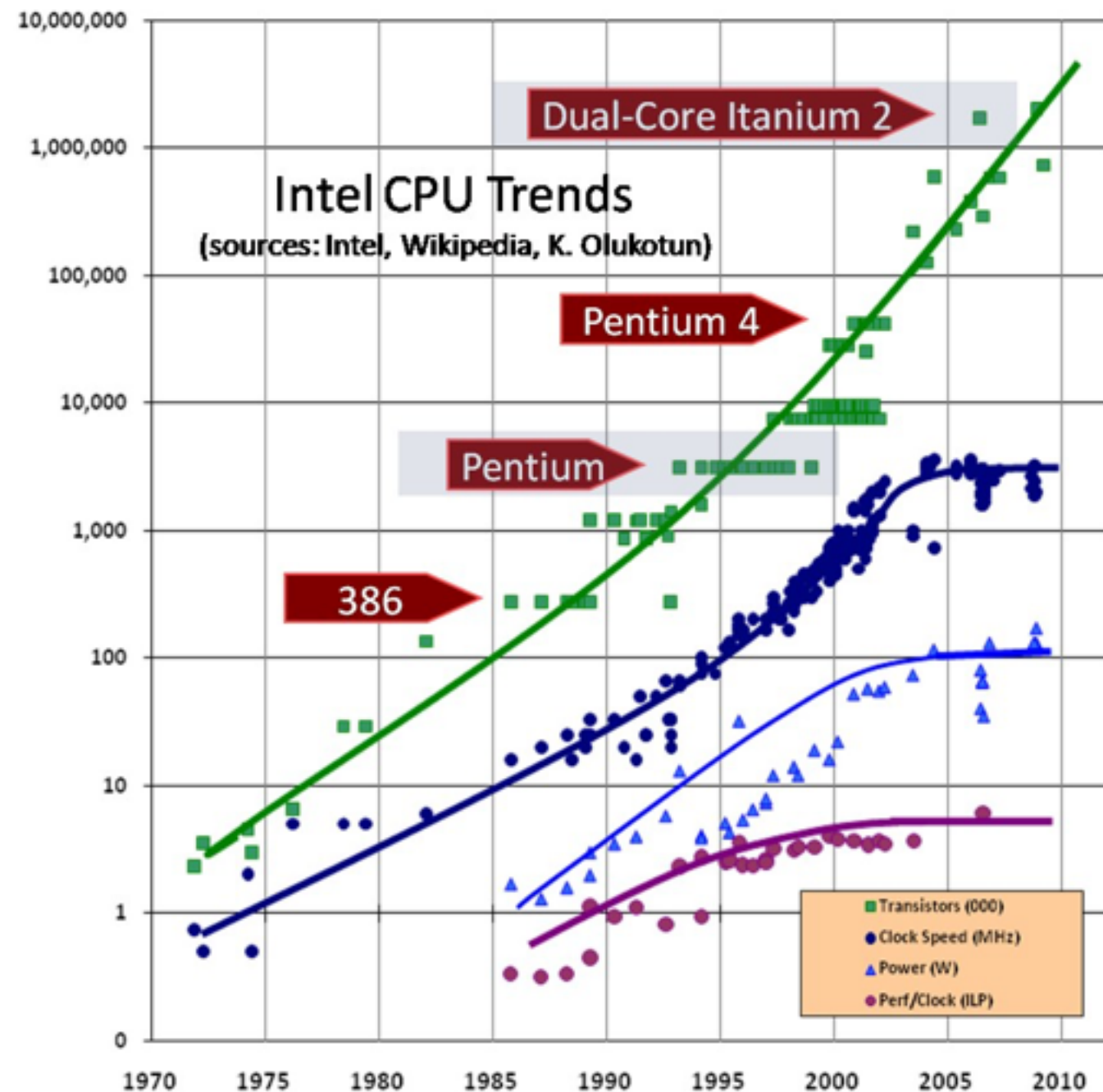
- “High Performance” - multiple cores, computers, or clusters with hundreds to thousands of cores
- “Scientific Computing” - problems that appear in optimization, numerical analysis, geometry, data analysis

## Microprocessor Transistor Counts 1971-2011 & Moore's Law



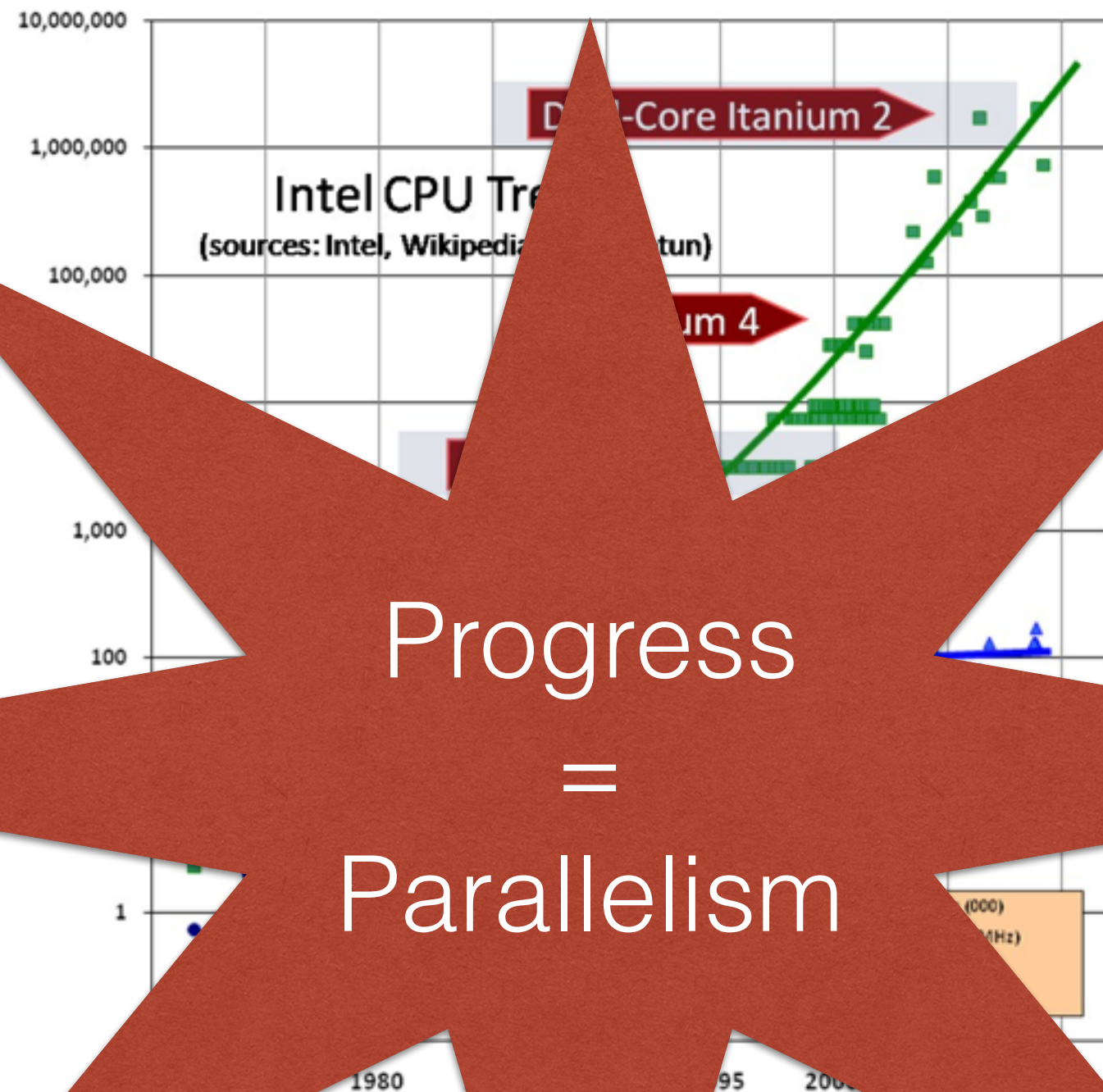
# Moore's Law

# transistors on a CPU doubles every two years



# Moore's Law

\*but clock speed and FLOPS are not doubling every two years



Progress  
=  
Parallelism

# Moore's Law

\*but clock speed and FLOPS are not doubling every two years





# MILKYWAY-2

Current world's fastest supercomputer.

<http://top500.org>



# Course Goals

- techniques for writing fast single-core, multi-core, and multi-machine code
- tools for managing “programmer time”
- applications and tools for scientific computing

*Knowledge gained from course will be useful for both supercomputers as well desktop environments.*

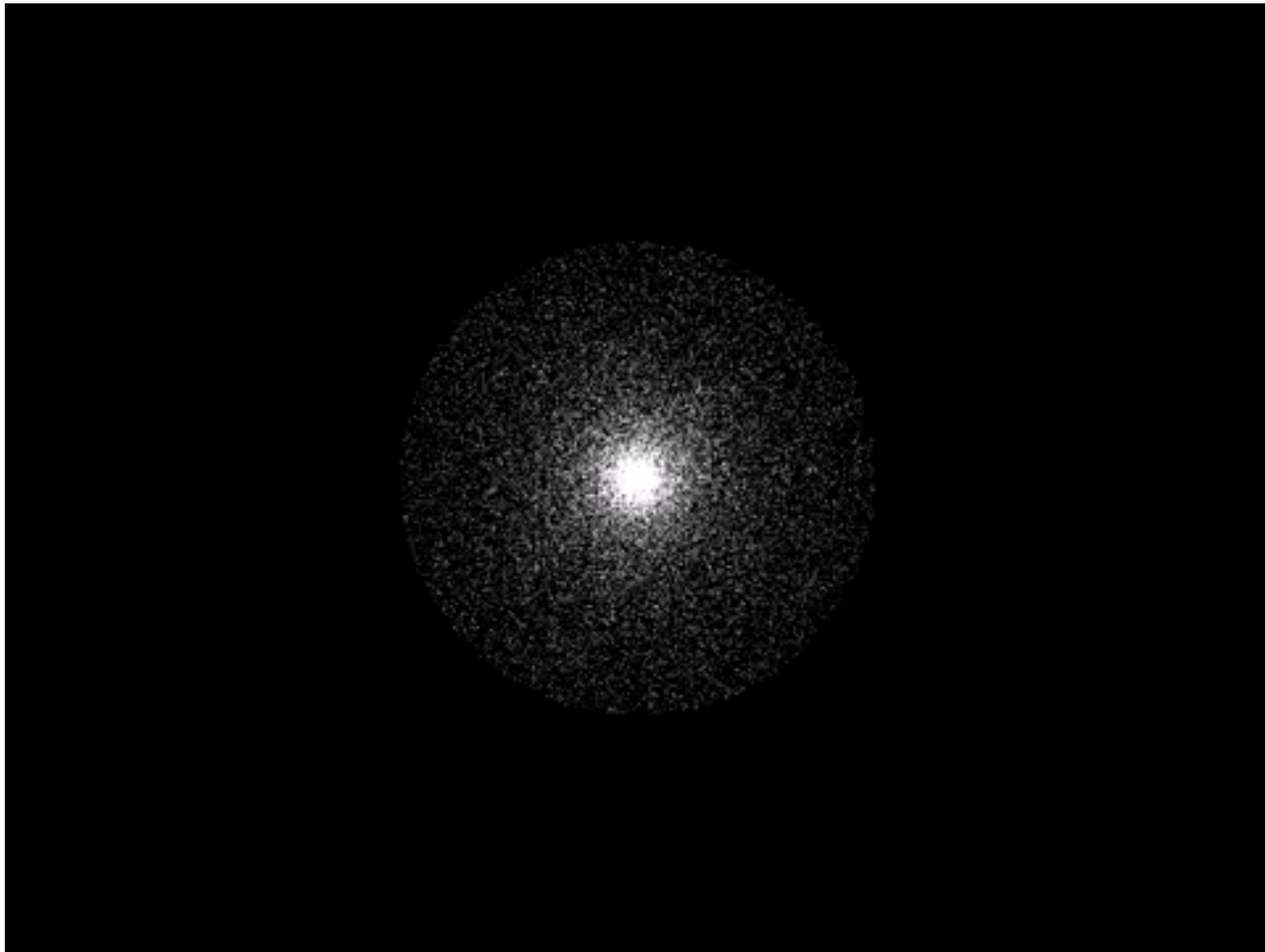
# Course Goals

- **Software efficiency**
  - computer hardware: CPU, memory, floating point arithmetic, cache
  - Unix and command-line software development
  - languages: Python and C
  - efficient single-core programming
  - parallel programming with OpenMP and MPI

# Course Goals

- **Programmer efficiency**
  - version control systems
  - makefiles and scripting
  - debugging code
  - test suites
  - reproducibility: documentation and reusability

# N-Body Simulation



# Parameter Optimization

# Syllabus (link)

[uwpsc-2016 / syllabus](#)


Unwatch 5Unstar 1Fork 1








[Code](#) [Issues 0](#) [Pull requests 0](#) [Wiki](#) [Pulse](#) [Graphs](#) [Settings](#)


Spring 2016 Course Syllabus and Information (SUBJECT TO CHANGE) — Edit

41 commits1 branch0 releases2 contributors

Branch: master [New pull request](#) [New file](#) [Upload files](#) [Find file](#) [HTTPS](#) <https://github.com/uwpsc-2016/syllabus> [Download ZIP](#)

 **cswiercz** Add links to canvas page and homework Latest commit 8f9b6ce 11 minutes ago

	Upload some homework submission images	25 days ago
	Add question template for asking questions	a month ago
	Fix minor formatting issue in final exam section	33 minutes ago
	Clarify submission process and clean typos	25 days ago
	Fix broken links	an hour ago
	Add links to canvas page and homework	11 minutes ago
	Fill in rest of syllabus topics	3 days ago

 **README.md**

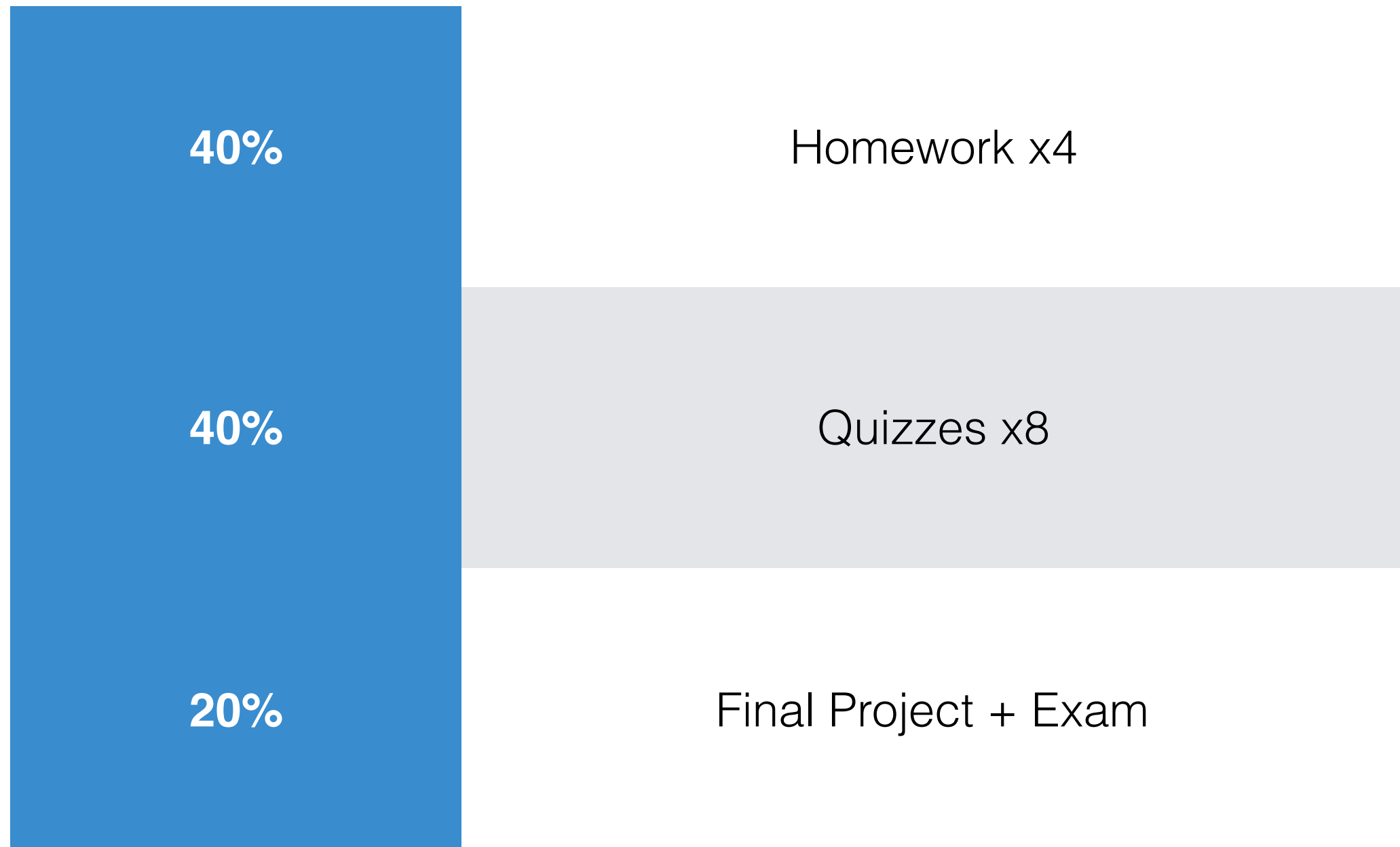
Disclaimer: The content of this document and the other documents in this repository are subject to change until the start of the Spring 2016 Quarter.

## AMath 483/583 Spring 2016 - High Performance Scientific Computing

Instructor: Chris Swierczewski ([cswiercz](#))  
Teaching Assistants:



# Grading



# Homework - 40%

- Automated Tests
  - “toy” test suite given to students
  - additional tests described, but not given
- Report and Analysis
  - derivations, analysis, plots

**60 / 100**

Automated Tests

**20 / 100**

Report and Analysis

**10 / 100**

Documentation and  
Reproducibility

**10 / 100**

Performance\*

# Homework - 40%

- Documentation and Reproducibility
- Performance
  - - 3 std. dev. — 0 / 10 pts
  - - 2 std. dev. — 5 / 10 pts
  - +/- 1 std. dev. — 10 / 10 pts
  - + 2 std. dev. — 15 / 10 pts

**60 / 100**

Automated Tests

**20 / 100**

Report and Analysis

**10 / 100**

Documentation and Reproducibility

**10 / 100**

Performance\*

# Quizzes

- Every Monday (including next week!)
- Understanding of Lecture Content and Assigned Reading from previous week
- Taken online via Canvas
  - 15 minutes timed
  - Start: Monday at 4:15pm
  - End: Monday at 4:45pm

# Academic Integrity

- **Dont's:**
  - you may not work as a partner with another student on an assignment,
  - you may not show your solutions to another student or look at their solution,
  - you may not discuss homework solutions in the course chat room or on the Issues pages,

# Academic Integrity

- **Dos':**
  - asking for help in understanding a part of a lecture,
  - assistance in the use of a software tool or library
  - requesting a reference on a given software tool or library,
  - discussion of topics beyond the scope of this course. (It's fun!)



# Asking Questions

- I will not answer email about the course after the first week.
- All questions should be posted to the appropriate repository's Issues Page in GitHub
  - logistics questions —> [Syllabus Issues](#)
  - Homework #1 Questions —> Homework #1 Issues Page
- Gitter Chat Room
  - online office hours (TBD)

# Lecture Notes

- See “[Lectures](#)” repository
  - slides
  - code
  - other notes

# Philosophy of the Course

- Many topics to cover! - Not enough time.
- Lectures are “introductions” to topics.
- Lectures and Homework give enough “hands on” experience for further experimentation.
- **Primary** and **Secondary References** (see [Syllabus](#)) are major source of information.

# Philosophy of this Course

- There is no textbook for life, but there are countless resources.
- Learn how to find information on the internet, in books, from each other.

# Prerequisites

- Courses:
  - Math 301 or CSE 142
- Highly recommended
  - solid linear algebra background
  - solid programming skills

# Before we continue...

- **Homework** - follow instructions on the [New Student Checklist](#)
- **Homework** - Learn Python
  - quiz next Monday - basic Python, Unix, and Git
  - [Official Python Tutorial](#) Sections 3,4,5,6,14



# Demo: SageMathCloud and the Terminal