Teaching with Version Control

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http://www.phdcomics.com/comics/archive.php?comicid=1531

Students must be taught to use version control.

The sooner the better.

e.g. in first programming course,
and used regularly in later courses

Benefits:

- For their own work
- To ease building on their work
- To contribute to software projects

Useful far beyond programming...

- Writing papers, proposals, etc.
- Collaborating on slides, posters, etc.

Important component to increase "reproducibility" in CSE...

Ability to determine exactly how scientific results were obtained.

- Basis of scientific method.
- Required for confidently building on past results.
- Critical for accountability in engineering analysis / decision making.

Standards and best practices in computational/data science are not yet well codified.

- Experimental science: Lab notebooks, methodology section of publications, etc.

Increasing interest in topic from funders, journals, public, ...

National Research Council workshop on

Statistical Challenges in Assessing and Fostering the Reproducibility of Scientific Results

February 26-27, 2015

http://sites.nationalacademies.org/DEPS/BMSA/DEPS_153236

AMath 483/583

High Performance Scientific Computing **[webpage]**

2013: ≈ 50 undergrads, 70 grad students (20 online)
+ **Coursera edition**

Topics:

- Git, bitbucket
- Python, IPython notebooks
- bash
- Makefiles
- Fortran 90
- OpenMP
- MPI

Git used to distribute course materials,
and for turning in all homeworks.

AMath 483/583

2014: "Flipped" the class using 2013 videos.

Two hours of lab sessions each week

Some problems:

- Git was often used only for submission
- Didn't work collaboratively
- Software stack:

  2013: Used VirtualBox VM

  2014: Used **SageMathCloud**

SageMathCloud™ – collaboratively use Sage, IPython, LaTeX, and terminals in your browser.

- **Mathematics:** use the best open source mathematics software (Sage, R, Octave, Python, Cython, GAP, Pari, Macaulay2, Singular, and more)
- **Edit:** collaboratively edit Sage worksheets, LaTeX documents and IPython notebooks
- **Program:** write, compile, and run programs in most programming languages
- **Teach:** organize teaching a course
- **Backup:** all files automatically snapshotted every few minutes
- **Terminal:** full Linux account with color terminal
- **Collaborate:** over 30,000 monthly active users

Create a free account at: **cloud.sagemath.com**

Presentation by William Stein on March 10, 2015:

`http://uwescience.github.io/reproducible/presentations.html`

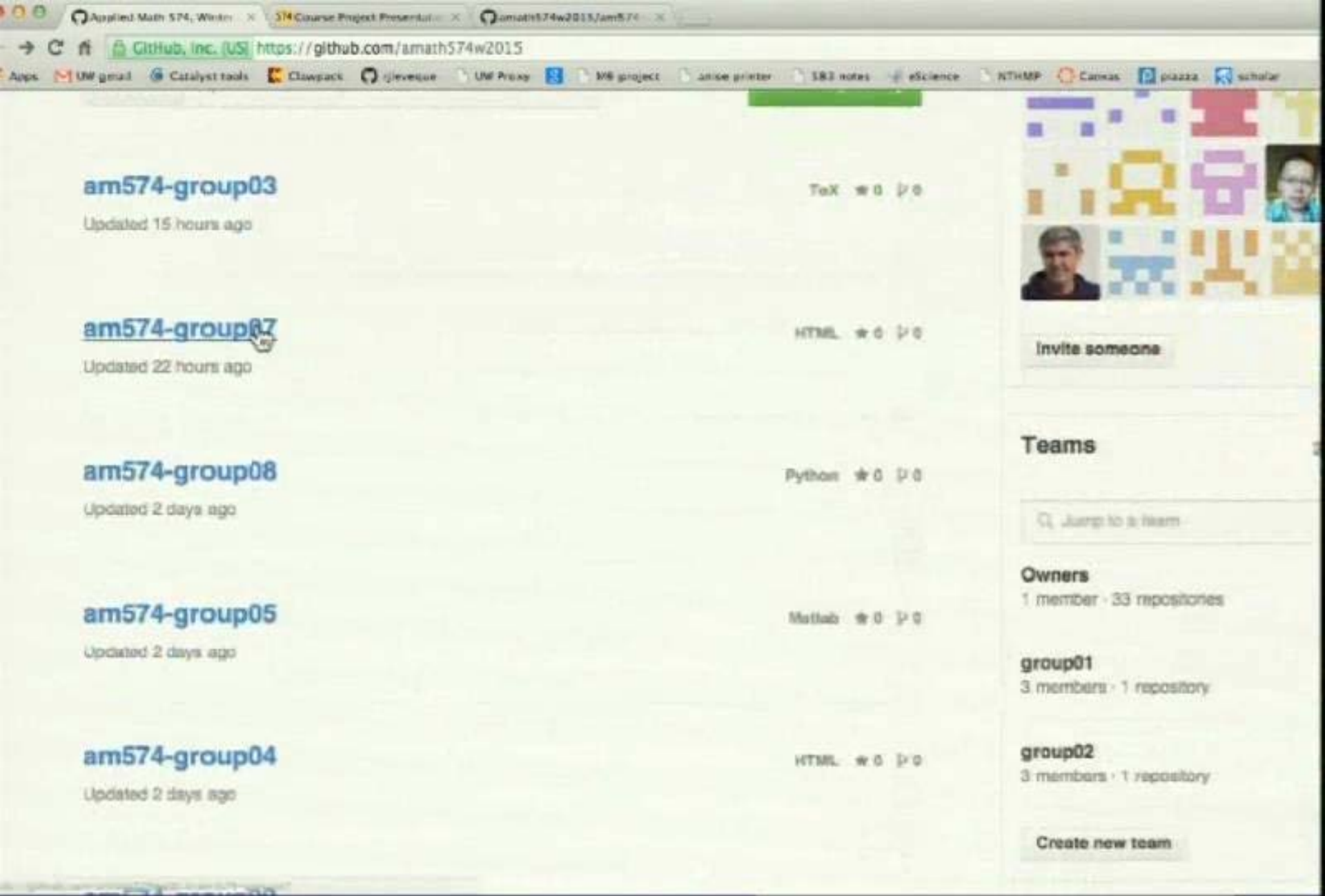
AMath 574 – Hyperbolic PDEs, Finite Volumes

GitHub "organization": **https://github.com/amath574w2015**

with private repositories `am574-student01`, etc.

and public repositories `am574-class`,
and `am574-group01`, etc.

See: GitHub for Education,
https://education.github.com/


GitHub, Inc. [US] https://github.com/amath574w2015
am574-group03
TeX
Updated 15 hours ago
am574-group07
HTML
Updated 22 hours ago
am574-group08
Python
Updated 2 days ago
am574-group05
Matlab
Updated 2 days ago
am574-group04
HTML
Updated 2 days ago
Invite someone
Teams
Owners
1 member · 33 repositories
group01
3 members · 1 repository
group02
3 members · 1 repository
Create new team

Peer review

For homework:

Used scripts to copy one file (e.g. IPython notebook) from each each student's repo to a different one (some mapping)

Push to Github

Students pull, comment in notebook, push

Copy back (invert mapping), push comments

Other tools for peer review?

Aslak Bergersen, Hans Petter Langtangen:

`https://github.com/hplgit/virtual-classroom`

Group projects

Groups of 2 worked on projects for last few weeks.

- Collaborated via GitHub, learned to merge
- Facilitated peer review of code, reports, presentations (some via Issue Tracker)

Repositories contain all materials:

`http://faculty.washington.edu/rjl/classes/am574w2015/project_presentations.html`

Course Project Presentations

Students will present [illegible] in two sessions:

Wednesday, March 11, 4:00 – 5:00pm

In [illegible] 026

4:00 – 4:20: [illegible]

- TITLE: Introduction to WENO Methods
- ABSTRACT: [illegible] ENO [illegible] successful at capturing shock [illegible] for shocks and high order accuracy for smooth data. [illegible] equations with shocks. We will also include comparison with CLAWPACK's [illegible] WENO [illegible] benefits of using Total Variation [illegible] Runge-Kutta [illegible] TVD [illegible]
- MATERIALS: [illegible]

4:20 – 4:40: [illegible]

- TITLE: Models of Traffic Flow with [illegible]
- ABSTRACT: [illegible] models of traffic flow based on Lighthill–Whitham–Richards model [illegible] PDE solver [illegible] CLAWPACK [illegible] is explored. [illegible]
- MATERIALS: [illegible]

4:40 – 5:00: [illegible]

- TITLE: Comparison of Two Second Order Traffic Flow Models
- ABSTRACT: While the Lighthill–Whitham–Richards traffic flow model behaves well macroscopically, it does not [illegible]

Summary

- Version control can be incorporated into courses
- Teach collaboration too.
- Some class time must be invested
- Lots of other resources available, e.g.

  help.github.com

  www.clawpack.org/git_resources.html