Research Tools and Methods for the Mathematical Science

Lecture 6: Backups and Revision Control

Matthew Roughan
<matthew.roughan@adelaide.edu.au>
http://www.maths.adelaide.edu.au/matthew.roughan/Lecture_notes/ResearchToolsCourse/

School of Mathematical Sciences,
University of Adelaide

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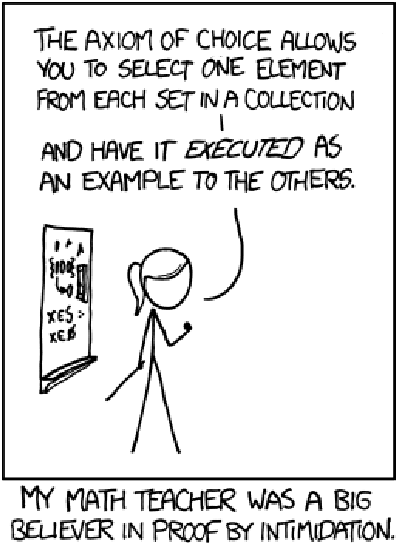
Proof by Intimidation: "Don't be stupid, of course it's true."

Proof by Terror: When intimidation fails ...


THE AXIOM OF CHOICE ALLOWS YOU TO SELECT ONE ELEMENT FROM EACH SET IN A COLLECTION
AND HAVE IT *EXECUTED* AS AN EXAMPLE TO THE OTHERS.
MY MATH TEACHER WAS A BIG BELIEVER IN PROOF BY INTIMIDATION.

http://xkcd.com/982/

Data storage requirements

The ARC and NHMRC's "Australian Code for the Responsible Conduct of Research", requires, amongst many others issues:

> In general, the minimum recommended period for retention of research data is 5 years from the date of publication.
>
> *Section 2.1.1*

Your funding (for those with scholarships) implicitly commits you to this policy.

- retention isn't just about holding it
- it must be readable (and understandable)

> Retain research data, including electronic data, in a durable, indexed and retrievable form.
>
> *Section 2.6.4*

Adelaide Uni Policy
Adelaide Uni Information
Adelaide Uni Training

The scary stories

- Student lost their entire thesis (almost finished) when a hacker cracked their laptop, and encrypted the drive
- I asked a colleague for a dataset they had used in a paper, as I wanted to do a comparison with a new algorithm. They couldn't find the data.
- I have a nice example of a problem that happened, but I can't find where I wrote it up.

Backups

- MANDATORY
- Your responsibility (even if someone says they are doing them for you)
    - I once lost a nice chunk of data when a disk crashed, and when I asked for the backups, was told some disks had been corrupted and they didn't work.
- Backups are NOT REAL unless you test them (regularly)

Backup models

- incremental/differential vs full
  - most things on your system change rarely, so why record the things that haven't changed?
- unstructured vs system
  - do you just record the files you "need"?
- continuous (e.g. RAID)
- off-site vs local
- how do you access the data (online, database, snapshot, ...)

External hard-drive

- unstructured:
  - copy some files to it, sometimes
  - requires discipline and care
- time machine
  - differential++
  - nice interface
  - BTA (Better Trust Apple)
- questions:
  - how do you do off-site?
  - how reliable is an external drive?

Cloud storage: e.g. Dropbox

Nice features:

- auto-backup (one-month history)
- distributed (access almost anywhere)
- sharable (can give access to others)

Problems:

- sync
- easy for someone to delete or break something
  - in theory can recover
  - recovery is manual – what if lots was lost?
- churn – puts stress on networks, potentially

Does protect against a disk failure.
Doesn't protect (properly) against a hacker deleting everything.

Collaborative writing

> Co-authors wont save you any time, but they do help filter out your idiosyncrasies.
>
> *Jeff Ullman [KLR89, p.67]*

- Most of your writing will be collaborative
  - often participants are distributed
  - there are lots of ways to deal with this
  - even when they are local, these techniques help
- Models:
  - One person acts as editor, and incorporates changes
    - others communicate proposed changes

    lots of work for editor, but only they end up happy.
  - Token: one person has the "token" (for all or part)
    - edit as please when have token
    - pass it when finished (e.g. by email)

    great with timezones, but requires trust.
  - Truly distributed:
    - all have access, and can edit
    - conflicts are merged

    very powerful, but requires tools.

Collaborative writing models

Truly distributed collaboration

Equally applicable for code or LaTeX or ...

- We want tools that support
  - distributed access – e.g. Dropbox
  - revision control [Hen07]
- Examples:
  - payfor: Scribetex, writeLaTeX, SpanDex, ShareLaTeX
    - often have a free plan, but are they free forever?
    - focussed on latex, not the rest (e.g. accompanying code and data)
  - Latexlab (google docs integration) http://docs.latexlab.org/docs
  - free: standard open source tools
    - revision control
- This is a field in flux ...

Revision (or version) control

Truly distributed collaboration

- Examples:
  - git
  - svn
  - cvs
- Features:
  - allow you to see all revisions of paper
    - e.g. revert back to an old version if you don't like changes
  - trace activity
    - volume
    - also what changed, with comments
  - atomic operations (cvs lacks this)
    - even if something is interrupted, system is left in consistent state
  - file locking (some systems)
- Good for code, and LaTeX, and (some) data
- Comparison of revision control systems

Git instructions

Many howtos and primers, e.g.

- http://stackoverflow.com/questions/315911/git-for-beginners-the-definitive-practical-guide
- http://sixrevisions.com/resources/git-tutorials-beginners/
- http://starlink.jach.hawaii.edu/starlink/GitPrimer
- http://wiki.kokuaviewer.org/wiki/Git_Primer
- http://www.doblock.com/articles/a-git-primer-fit-for-linus-himself
- http://software-carpentry.org/v5/novice/git/index.html

Git instructions

Only a few simple operations needed to get started:

clone create a copy of a repository

```
git clone git://github.com/something.git
```

add add files to the repository

`git add` *filename*

commit commit your changes

`git commit` *filename*

push push a set of committed changes to the repository

```
git push
```

pull pull (update) from the repository

```
git pull
```

but there are lots of other things you can see and do.

GitHub https://github.com/

- Provides an online (cloud) version of git with a nice set of interfaces.
  - can use web interface for many things
  - also a Mac GUI client
- 2011 numbers
  - used by 2 million projects
  - 4,500 new GitHub projects per day
- We have an institutional account
  - I am the admin
  - I can set up a private project for you
- Getting started requires you jump through a few hoops:
  https://help.github.com/categories/53/articles
  https://help.github.com/categories/54/articles
- Lots of help, e.g., https://help.github.com/

Why not Dropbox + git?

- Sync – state in Dropbox might not be sync'd when you commit
  - non-atomic
- Overlap of functionality
  - both keep some type of history
  - inefficient and inelegant
- Dropbox is chatty
  - do you want to colleagues to see every single change you make? or just the new draft?
- Simultaneous edits are bad in Dropbox

Collaborative writing

Using revision control effectively for writing

- Line-wraps: don't have one para per line
  - every change changes the whole paragraph
- Break into segments (using LaTeX includes)
  - can be independently edited
- Use standard packages (everyone has)
- Sharing .bib files
  - agreed keyname format
- Use "ignores" to keep "products" out of the repository
  - in coding "binaries" are the products
  - are PDFs a "product"?
  - what about images?
- Verify LaTeX compiles before committing it

See http://stackoverflow.com/questions/6188780/git-latex-workflow and https://www.sharelatex.com/blog/2012/10/16/collaborating-with-latex-and-git.html for more discussion.

Summary

- YOU are responsible for your backups
  - Backups are insanely important, but you won't realise that until you don't have them
- Revision control will make your life easier

Assignment

Get a GitHub account

- If you need help follow the instructions on `https://help.github.com/categories/53/articles`
- Let me know your account name
- I'll give you (read) access to the course repository
- I'll set up a "thesis" repository for you.
  - if you get your supervisors to join GitHub (or they already have), then I will include them into your repository.

Further reading I

Arne Henningsen, *Tools for collaborative writing of scientific LaTeX documents*, The PracTEX Journal (2007).

Donald E. Knuth, Tracy L. Larrabee, and Paul M. Roberts, *Mathematical writing*, Mathematical Association of America, 1989, jmlr.csail.mit.edu/reviewing-papers/knuth_mathematical_writing.pdf, contains a huge amount of very good advice, but loosely organised (just reports of a set of lectures).