An Introduction to Git and GitHub

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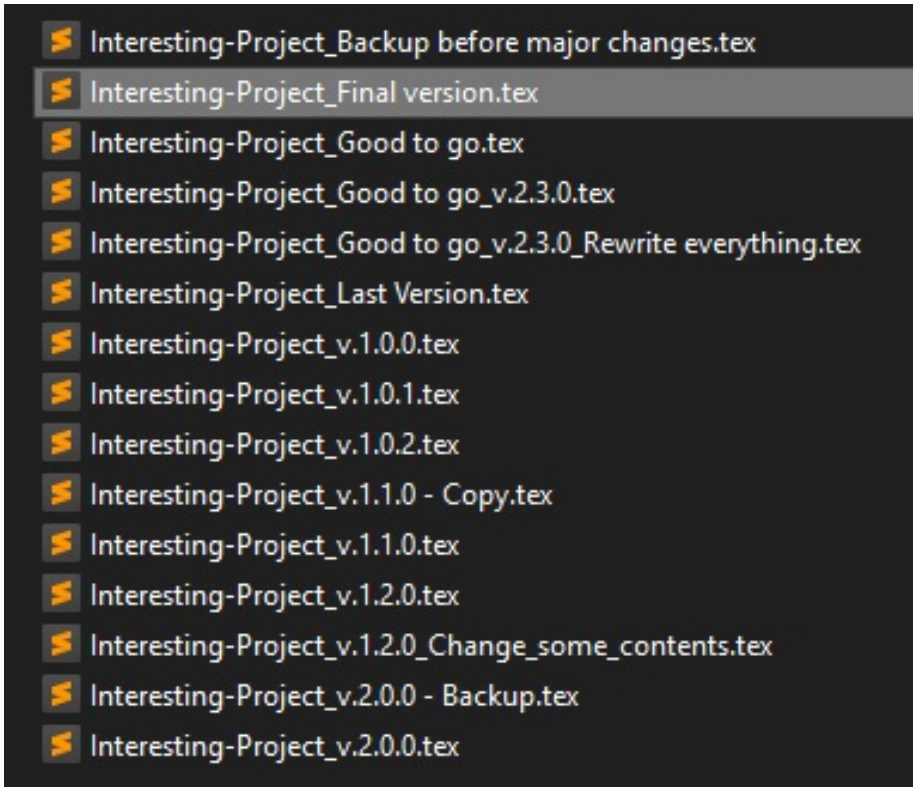
Outline

Feel free to check this slide on
`https://github.com/isaac0821/UB-INFORMS-Git-Workshop`

Version Control

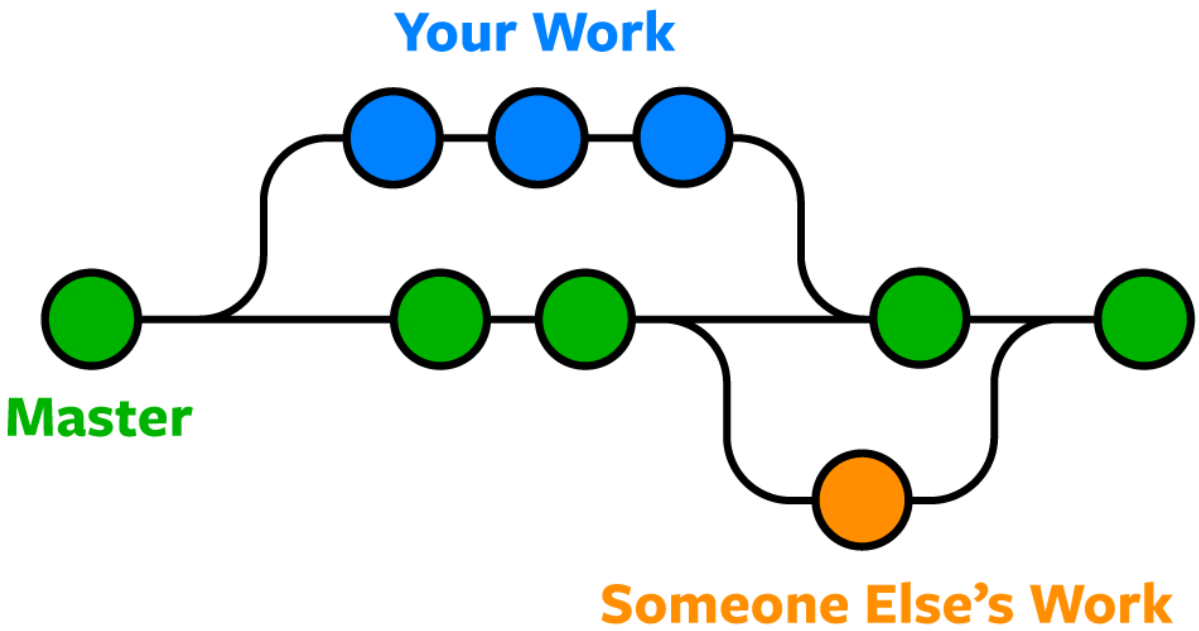


Version Control

The disadvantage of control version in this way

- Too messy, hard to find the latest (time stamps sometimes can't help)
- Cannot compare the difference between each version
- Cannot merge changes in different edition from one or more participants
- Cannot keep track of changes

Git is a distributed version-control system for tracking changes in source code during software development.It is designed for coordinating work among programmers, but it can be used to track changes in any set of files.



Installation

- Windows: `https://git-scm.com/downloads`
- Linux: `sudo apt-get install git`
- Mac OS:
  1. Install `Xcode` from AppStore
  2. Run `Xcode`
  3. In `Xcode -> Preferences` find `Downloads`
  4. Choose `Command Line Tools`, install it

Installation

After installation, open the terminal and input `git` to see if it is successfully installed. There should be something like this:

```
C:\Users\isaac>git
usage: git [--version] [--help] [-C <path>] [-c <name>=<value>]
           [--exec-path[=<path>]] [--html-path] [--man-path] [--info-path]
           [-p | --paginate | -P | --no-pager] [--no-replace-objects] [--bare]
           [--git-dir=<path>] [--work-tree=<path>] [--namespace=<name>]
           <command> [<args>]

These are common Git commands used in various situations:

start a working area (see also: git help tutorial)
   clone             Clone a repository into a new directory
   init              Create an empty Git repository or reinitialize an existing one

work on the current change (see also: git help everyday)
   add               Add file contents to the index
   mv                Move or rename a file, a directory, or a symlink
   restore           Restore working tree files
   rm                Remove files from the working tree and from the index
   sparse-checkout   Initialize and modify the sparse-checkout

examine the history and state (see also: git help revisions)
   bisect            Use binary search to find the commit that introduced a bug
   diff              Show changes between commits, commit and working tree, etc
   grep              Print lines matching a pattern
   log               Show commit logs
   show              Show various types of objects
   status            Show the working tree status

grow, mark and tweak your common history
   branch            List, create, or delete branches
   commit            Record changes to the repository
   merge             Join two or more development histories together
   rebase            Reapply commits on top of another base tip
   reset             Reset current HEAD to the specified state
   switch            Switch branches
   tag               Create, list, delete or verify a tag object signed with GPG

collaborate (see also: git help workflows)
   fetch             Download objects and refs from another repository
   pull              Fetch from and integrate with another repository or a local branch
   push              Update remote refs along with associated objects

'git help -a' and 'git help -g' list available subcommands and some
concept guides. See 'git help <command>' or 'git help <concept>'
to read about a specific subcommand or concept.
See 'git help git' for an overview of the system.
```

GitHub

- A/the global company that provides hosting for software development version control using Git
- A website Microsoft just bought for $7.5 billion dollar
- A website that you can goof around when you are bored at coding and don't need to worry about getting caught by your manager (she/he might be doing the same thing)

Initialize/Clone

- `git init`

Create a `.git` folder in current path, making current path a git repository

- `git clone`

From a remote repository clone to current path

Branch

- List branches
  `git branch`
- Create a new branch
  `git branch [branchName]`
- Switch between branches
  `git checkout [branchName]`
- Create and switch to branch (2 steps in 1 line)
  `git checkout -b [branchName]`

Branch (cont.)

- Delete a branch (won't delete if there are unmerged changes)
  `git branch -d [branchName]`
- Delete a branch (will delete even if branch has unmerged changes)
  `git branch -D [branchName]`
- Rename a branch, default to be current branch
  `git branch -m [oldBranchName] [newBranchName]`
- Back to main branch
  `git checkout master`

Commit

The following are steps for commit

- Step 0: Check changes using `git status`
- Step 1.1: Add changes by `git add <filename>` or add all changes by `git add -A`
- Step 1.2: Discard changes by `git checkout <filename>`
- Step 2: Commit the changes by `git commit -m "Some description"`

After commit, the next step is push it to remote.
If you don't want to commit to remote and wnt to undo it

- Step 1: Find commit hash, `git log`
- Step 2: Revert commit, `git revert [commitHash]`, it actually create a new commit to revert this commit

- `git fetch`

Check if there is a new version, you might not want to pull at this moment

- `git pull origin <branch>`

From remote pull changes into local

- `git push origin <branch>`

Sync remote repository with local repository

Important

Always remember to pull before start editing, otherwise you might have conflicts

Merge

- Step 1. Go to the branch you need to merge into (e.g. master)
- Step 2. `git merge <branch>`

Pull Request

On GitHub website, you can find a buttom named `New pull request`. It "requests" the owner/admin of the repository to do a "pull" from your branch. After the owner pull your branch, your branch in remote will be deleted, but you will still have your local copy so the workflow will not be affected.

Conflict

If your version is behind the remote version, i.e., someone had changed the files and push to remote repository, you also made some changes in the same file before you `git pull` from remote.
Then when you try to `git push` your version to remote, a message will alert to let you `git pull` first.
Git will try to solve the conflict by itself, but it might not work.
Then you need to solve the conflict.

Solve conflict

If the conflict happens in a non-binary file (e.g., `.py`, `.tex`, basic every file can be edited by text editor), it is easy to solve:
Use text editor to open the conflict file, search for the following structure:

```
<<<<<<< HEAD
    [Text in your version]
=======
    [Text in remote version]
>>>>>>> [version number]
```

Edit it and `git add`, `git commit` again

For binary files (e.g., `.pdf`, `.exe`, `.docx`, `.dll`), it is hard to merge them. What we can do is choose a version.

- Resolve using your version

```
git add [conflictFileName]
git commit -m "I used mine version"
```

- Resolve using remote version

```
git checkout [conflictFileName]
git add [conflictFileName]
git commit -m "I used their version"
```

Tip

We don't like to merge changes in the same file, here are some tips to avoid that:

- Design by module, break large files into smaller files. Each group member works on separated file, have someone (e.g., team leader) design the interface between modules
- Sync with master branch more often
- Commit with small changes (it depends)

Your can try some other commands... just for fun

- `git diff`
- `git log`