

An Introduction to Version Control with git and GitHub

Modern Data Structures
GR 5072

Dr. Anderson

Agenda

- What is version control software
- What is git and GitHub
- Tools you will need
- Using git and Github Desktop
- End to end process for making a change

What is Version Control software?



The three aims of a Data Science project...

And how version control software supports these aims

1. Reproducibility

- Anyone should be able to arrive at your **same results**

2. Portability

- Anyone should be able to **pick up where you left off** on any machine

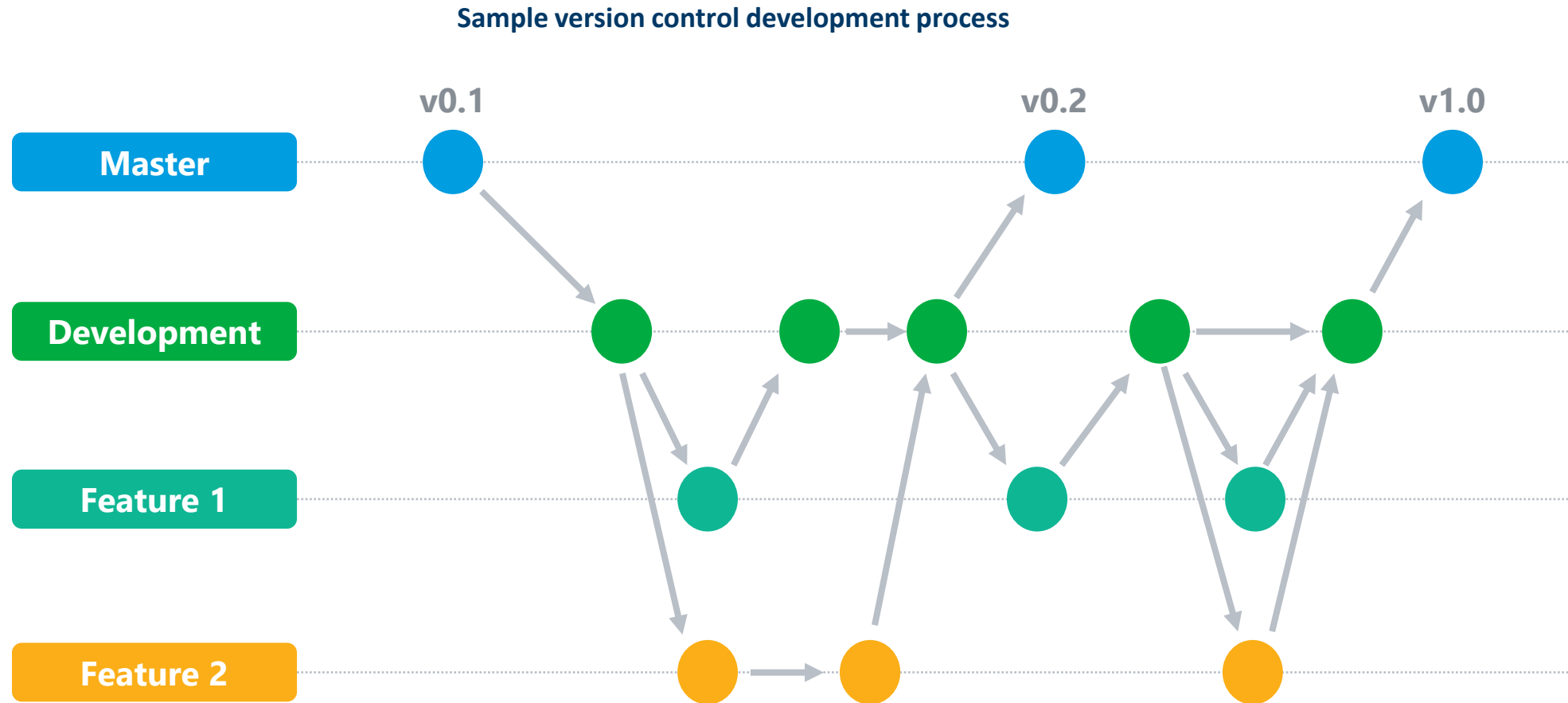
3. Scalability

- Your project should also work for **larger data sets** and/or be on the path of **automation**

- These three aims are crucial for **collaborative work**.
- **Version control** software:
 - Directly supports the three goals above, by storing “**snapshots**” of your code over time
 - Makes it easy for you or your teammates to see how the code has evolved over time

What is version control software?

Version control is software to manage development. It allows simultaneous work, gives clear control over integration of changes, and makes reviewing easier and more accurate



Version control software

GitHub and Bitbucket are the two main options and are used by almost every major company



Userbase

37 million users and more than 100 million repositories

Example Clients



Userbase

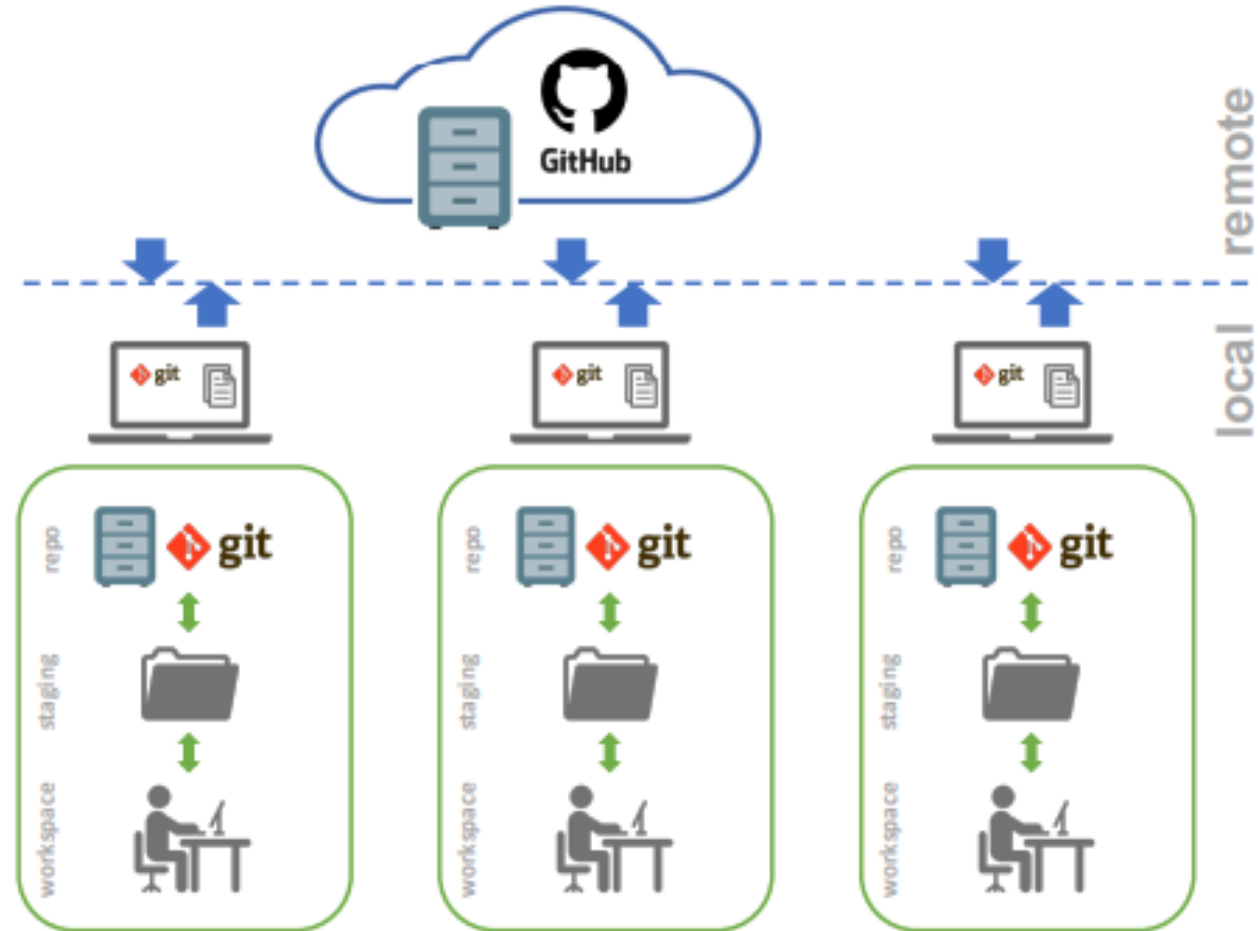
10 million registered users and over 28 million repositories

Example Clients



GitHub Enterprise is version control software used by corporations. While it is still managed by git / GitHub, data is stored in a different set of servers to keep each company's GitHub data siloed away

An ideal version control setup for collaboration



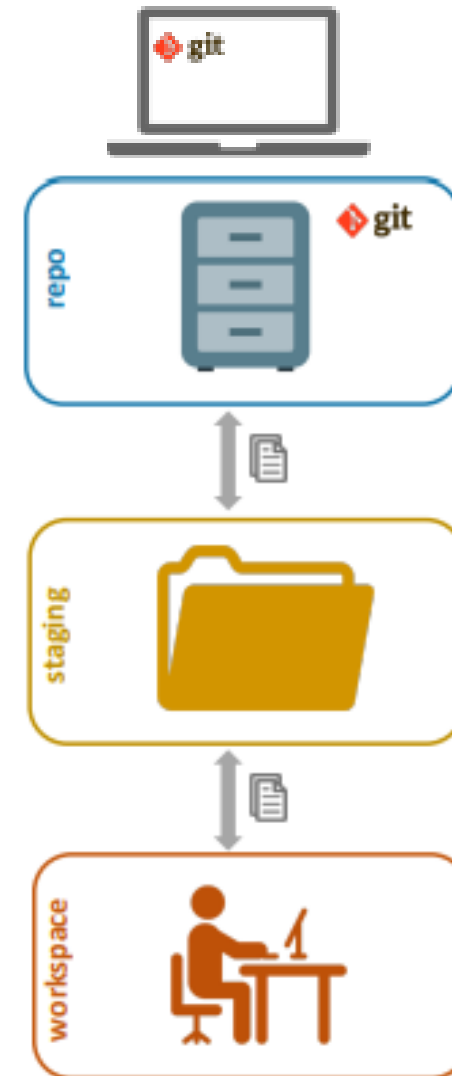
What is git and GitHub?

2

Recap: what is this git thing?

And how version control software supports these aims

- **git** is a version control software
 - It is installed “**locally**” on your computer (or virtual machine)
 - Tracks snapshots of your code over time
 - Allows you to “time travel” back to previous states of your code
 - Keep collaboration organized when multiple people are working on the same project

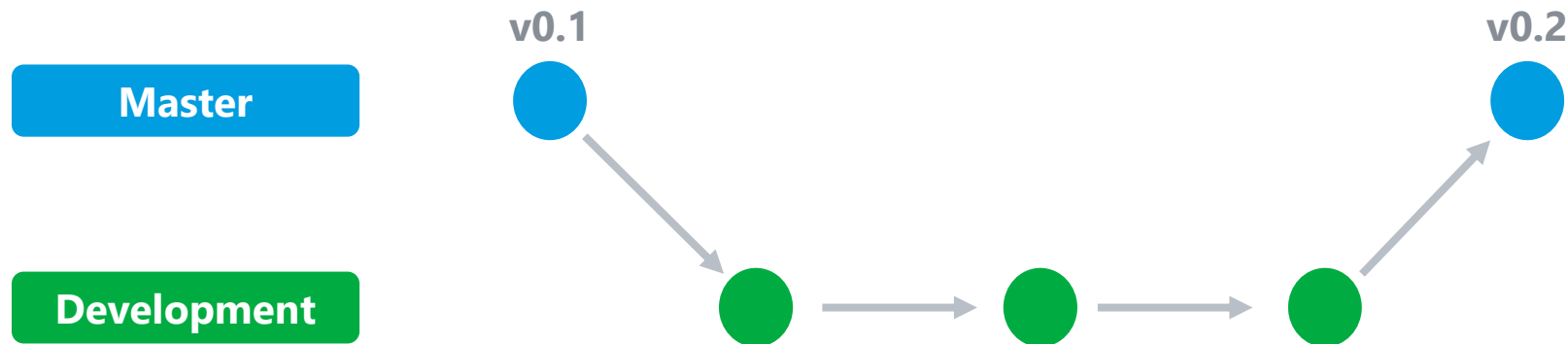


git: A menta model

How git works

The central idea of git is that it tracks changes made to files, allowing you to work in a separate versions (usually called a “Development” branch), while the main or master branch remains in a production-ready state

*Here the master, **production-ready** copy is kept separate from the development version until it is time to review and merge all updates*



How git works

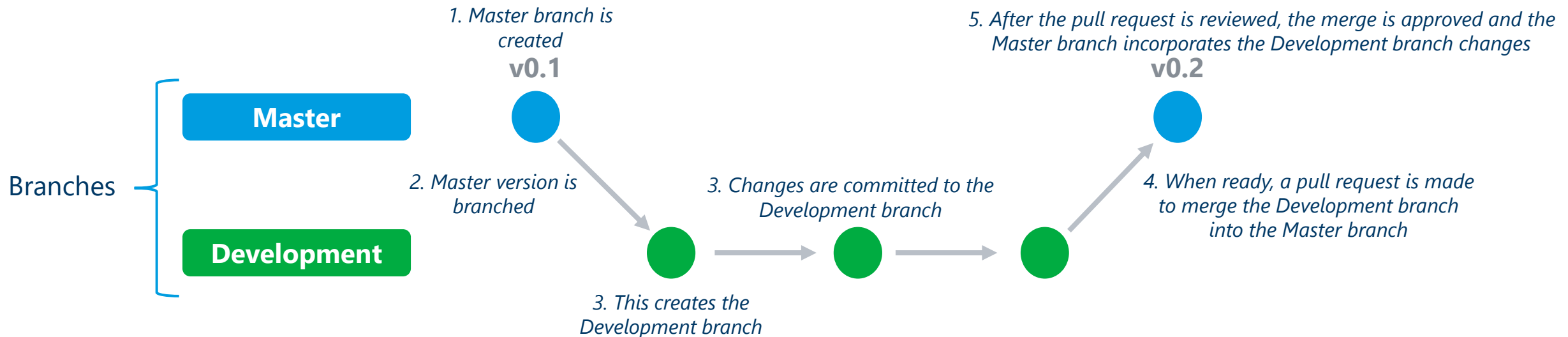
There is a well-defined workflow for making these separate versions and merging them together, which is important to understand

Making a copy of a version is called **branching** the version, this creates a new **branch**

Adding changes to a version is called **committing** changes, or **commits**

Commits are only saved on your local machine, until you **push** the updates to GitHub

Requesting that all these changes are merged back in is a **pull request**



commits: Tracking what's changed

Once you've committed the updates you've made, and pushed them to GitHub, you'll be able to see a side-by-side view of what's changed

Minor updates

main

NickAnderson94 committed 3 days ago

1 parent [dd3a5ba](#) commit [83770ee0bcbab74961a674c3bd92b1408a83ad98](#)

Showing 2 changed files with 2 additions and 16 deletions.

Filter changed files

2 Code

Checking thematic co...

ROPSO Analysis.Rmd

2 Code/Checking thematic codes.R

↑

@@ -222,7 +222,7 @@ rltsp_type2 <- ChiSqrTest(DV_df=DV_df[!is.na(dat1\$rltsp_type2),], IV =

222 222 first_love <- ChiSqrTest(DV_df=DV_df[!is.na(dat1\$first_love),], IV =

223 223 dat1\$first_love[!is.na(dat1\$first_love)])

224 224 # Combine results into a single table

225 - factor1 <- c(rep(rep(c(rownames(tests)[1:length(DV_df)]), each = 2), 3), rep(c(rownames(tests)

225 + factor1 <- c(rep(rep(c(rownames(tests)[1:length(DV_df)]), each = 2), 3), rep(c(rownames(tests)

226 226 factor2 <- c(rep(c("gender", "sexuality", "rltshp_status"), each = c(16)), rep("rltshp_type", times = 40),

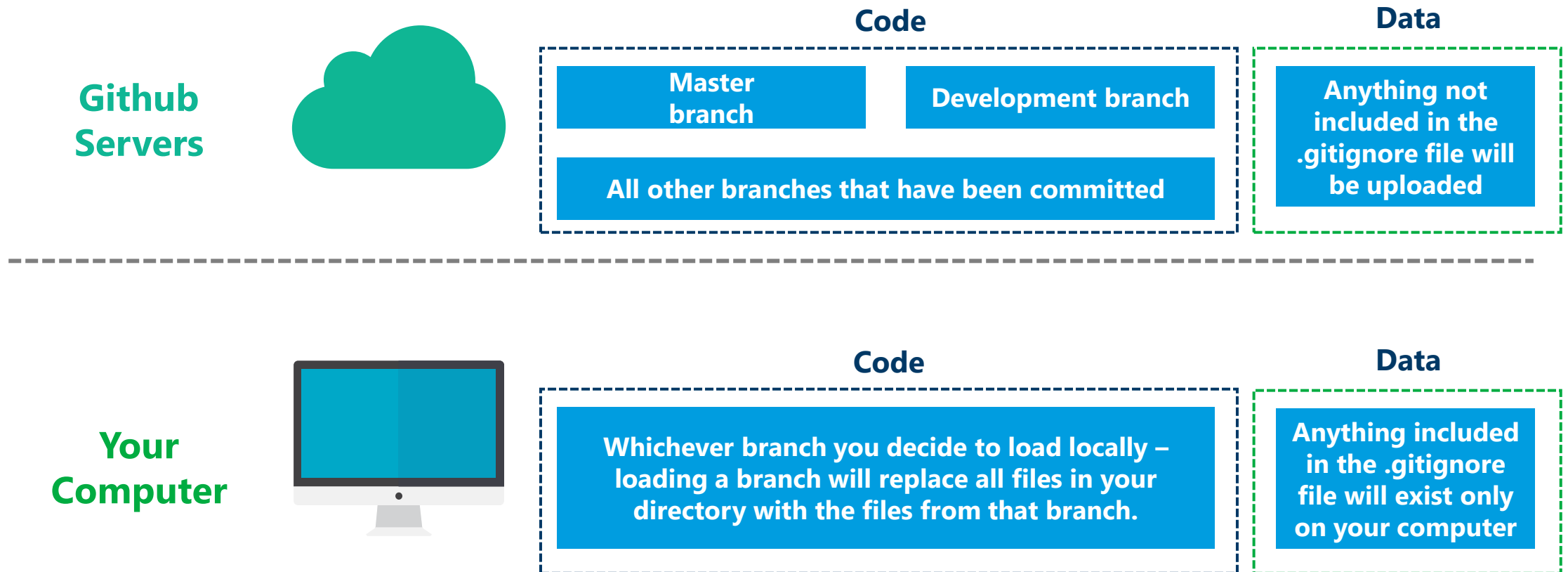
227 227 categorical_tab_results <- data.frame(cbind(factor1, factor2 , rbind(gender[[1]], sexuality2[[1]],

228 228 factor1 <- rep(rownames(tests)[1:length(DV_df)] , times = 5)

↓

What is GitHub

GitHub is a cloud service that hosts git repositories, in other words, all your code is stored on GitHub servers



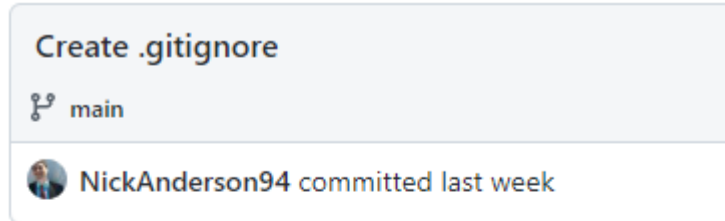
GitHub Benefits

- Persisting repository storage
 - No need to create folders on your computer for the same project files (e.g., “app final”, “app adding feature 1”, “app debugging issue 1”)
- Seamless transition between environments
- Essential for collaboration, and backing up code (you should use this on a daily basis)
- Synchronizes your work and minimizes the risk of people stepping on each other’s toes
- As we will see when we explore the GitHub website, it allows you to centrally track issues like bugs or product enhancements
 - You can categorize these issues based on the skills needed to address them
 - You can assign these issues to teammates

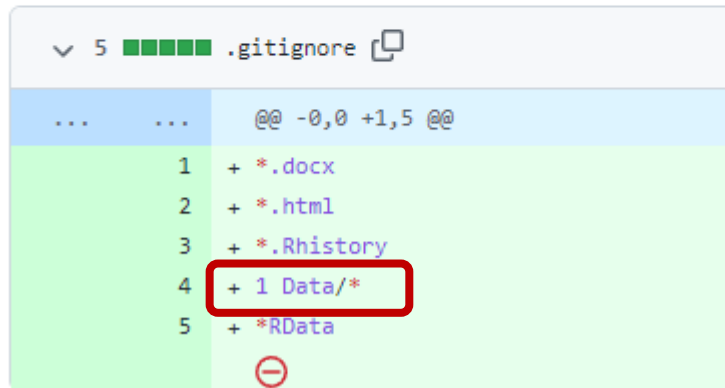
.gitignore

Use .gitignore files to designate which files / folders should not be uploaded to GitHub

Typically, this includes confidential data files, and other miscellaneous project files created as you work



Showing 1 changed file with 5 additions and 0 deletions.

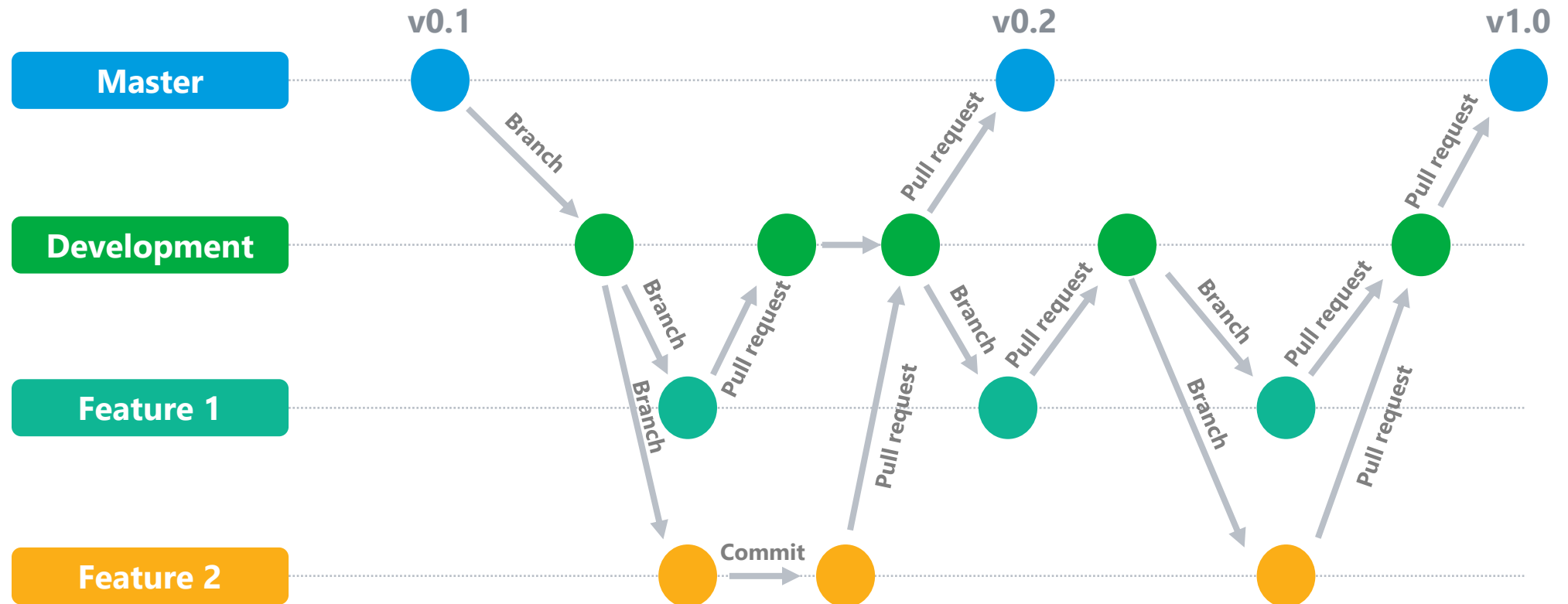


- In Python for example, we will be using Jupyter Notebook a lot this semester. So our **.gitignore** file will ignore Jupyter Checkpoint files:
 - We do this by adding ***.ipynb_checkpoints** to the .gitignore file
- See [here](#) for a guide to .gitignore syntax
- Note: You can use “#” for commenting out code
- To create a **.gitignore** file, use any text editor and follow these steps:
 1. Add the files/directories that you don't want git to track
 2. Click 'save as' name the file **.gitignore**
 - Note: This file **cannot** end in any other file extensions, like .txt
- A second option is copy and pasting other **.gitignore** files into a new directory
- A third option is to create them on GitHub when you create a new repo

How the Shiny apps Github works

Here you can see a sample workflow, with multiple features worked on simultaneously

Changes are being made independently in branches "Feature 1" and "Feature 2", then pull-requested into Development. Occasionally the latest version of Development becomes the latest full release when merged into Master



Branching: An Example

This shows four different branches, which would be typical for any production-ready application your team is deploying

Master

- The *Master* branch is the latest full release.
- Should be completely client ready and thoroughly reviewed.

Development

- The *Development* branch is the latest in-progress version.
- No changes should be made in it directly – you should make a new branch based off it (e.g. 'Feature 1'), make your changes in that, then make a pull request to merge that new branch into development.
- This way changes can be reviewed, and Development stays as a fully reviewed version.

Feature 1

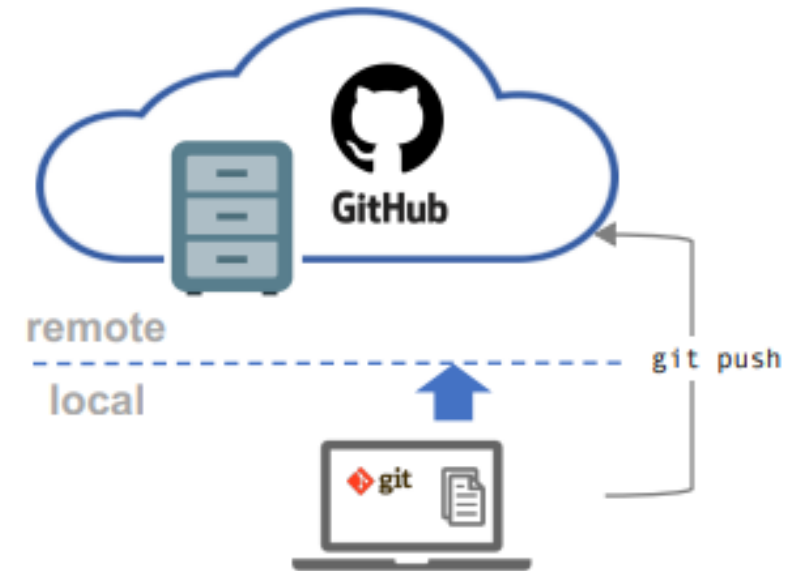
Feature 2

- Other branches are for new features, bug fixes, modifications etc.
- Create these by branching off development when you want to make any changes
- Name them something descriptive to what you're working on in them
- Its best to do little and often – make your new branch, change what you need to change, then make the pull request. This way reviews are shorter and changes can be merged more easily

Pro Tips to Using git

This shows four different branches, which would be typical for any production-ready application your team is deploying

- The first step to using git successfully is just understanding which files are on your local machine vs the GitHub cloud
 - git **push** and '**fetch**' **origin** are what you use to exchange information between the two
- **commit** small chunks of logically grouped changes
 - If you have modified separate files at once, it may make sense to **commit** these in separate batches
- **commit** with informative messages
- Currently, most people are using **main** as the default branch, used to be **master**



Review the key terms

How do we define the following terms?



- git
- GitHub
- Repository (aka, “repo”)
- commit
- branch
- pull request
- push request
- Challenge definitions for class:
 - “fetch” origin
 - fork

Tools you will need

3

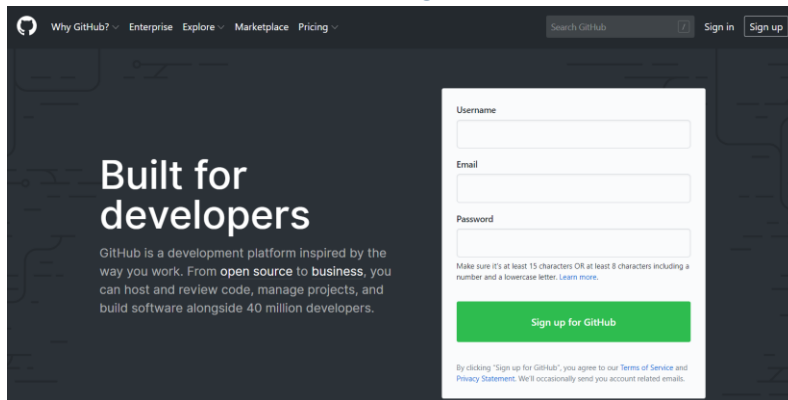
Tools you will need

Here you can see a sample workflow, with multiple features worked on simultaneously

Github.com

<https://github.com/>

- The central source for all code and project management



Github Desktop

<https://desktop.github.com/>

- A desktop tool to easily handle creating branches, loading branches, pull requests etc



Optional: Use git through the command line

- For advanced users

Using git and GitHub Desktop

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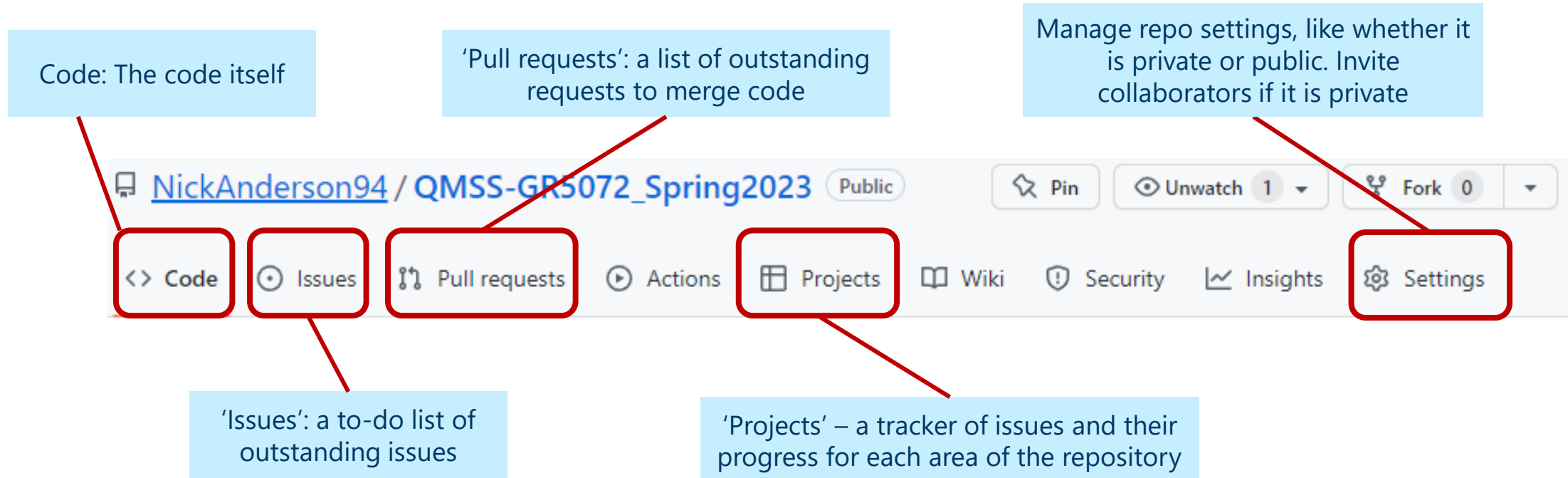
Using GitHub Desktop and GitHub

Please follow along on your local PCs as we explore the following on GitHub

- On GitHub web, we'll explore:
 - Accessing your repositories
 - Within a repo:
 - Code
 - Issues
 - Pull Requests
 - Settings
 - How to add **collaborators**
 - How to **protect** a branch (so only an **owner** can modify it)
- On GitHub Desktop:
 - Making a **commit**
 - Creating a new **branch**
 - Creating a **pull request**
 - **Pushing** to origin
 - How to **“fetch”** origin
 - How to create and use **.gitignore** files

Using Github Web: Overall

When on a particular repository's page, you can navigate with the bar at the top



Using Github Web: Code

The Code tab is where all the code resides, and can be viewed by branch

The screenshot shows the GitHub web interface for the repository 'NickAnderson94 / QMSS-GR5072_Spring2023'. The 'Code' tab is selected, showing a list of files and folders. Annotations with red boxes and lines point to various features:

- Select branch:** Points to the 'main' branch dropdown menu.
- Files and folders within the branch:** Points to the file list showing 'General Course Materials', 'Week 1/Programs', and '.gitignore'.
- See coding languages stored in the repo:** Points to the 'Languages' section at the bottom, which shows a bar chart for 'Jupyter Notebook 94.0%' and 'Python 6.0%'.
- Download a copy of the repository:** Points to the 'Code' button (with a download icon) in the top navigation bar.
- Click to view change history:** Points to the '11 commits' link next to the repository name.

The repository details on the right include: 'About' (This is the course repo for GR 5072. Modern Data Structures (Spring 2023)), '1 star', '1 watching', '0 forks', 'Releases' (No releases published), and 'Packages' (No packages published).

Using Github Web: issues

The issues tab is where issues are created and tracked – whether questions, feature requests, bugs etc. they all go here like a to-do list

The screenshot shows the GitHub interface for the 'angular/angular' repository. The 'Issues' tab is selected, showing 2,452 open and 19,744 closed issues. A red box highlights the 'New issue' button. Another red box highlights the first issue, 'Create a "Directives Overview" or similar topic', which is annotated with 'P3', 'comp: docs', and 'feature'. A third red box highlights the assignee's profile picture for this issue. Below the first issue, several other issues are listed, including 'Make FormArray's inability to be treated as a regular Array more prominent in the docs', 'bug(cdk-drag-drop): :enter / :leave animations are triggered incorrectly', 'The structural directive type check docs section is incomplete', 'Provide usage examples for APP_INITIALIZER token', and 'More precise type for APP_INITIALIZER token'. Each issue entry includes a title, labels, a status (e.g., 'needsTriage'), and a comment count.

angular / angular

Watch 3.2k Star 70.5k Fork 18.5k

Code Issues 2.5k Pull requests 292 Actions Projects 6 Security Insights

Filters is:issue is:open Labels 204 Milestones 10

New issue

2,452 Open 19,744 Closed

Author Label Projects Milestones Assignee Sort

Create a "Directives Overview" or similar topic P3 comp: docs feature
#40755 opened 2 hours ago by aikidave Backlog

Make FormArray's inability to be treated as a regular Array more prominent in the docs comp: docs comp: docs/api comp: forms
#40753 opened 6 hours ago by ychaikin needsTriage

bug(cdk-drag-drop): :enter / :leave animations are triggered incorrectly comp: animations
#40752 opened 9 hours ago by udos86 needsTriage

The structural directive type check docs section is incomplete comp: docs
#40739 opened 2 days ago by ArielGueta needsTriage

Provide usage examples for APP_INITIALIZER token comp: docs hotlist: community-help
#40730 opened 3 days ago by AndrewKushnir needsTriage

More precise type for APP_INITIALIZER token comp: core cross-cutting: types feature
flag: breaking change hotlist: community-help
#40729 opened 3 days ago by AndrewKushnir Backlog

Click on an issue to view it in more detail

Click to create a new issue

See who has been assigned to resolve an issue

Using Github Web: issues

Click on an issue to view it in more detail

The screenshot shows a GitHub issue titled "Finalize color scheme #8". The page is annotated with red boxes and lines pointing to various elements, which are described in text boxes on the left. On the right, there are additional annotations for the "Assignees", "Labels", and "Projects" sections. On the far right, a separate box shows a list of example labels.

Annotations on the left:

- The initial detail of the issue
- A comment on the issue
- Details of changes to the issue's categorization
- Place to enter a new comment on the issue

Annotations on the right:

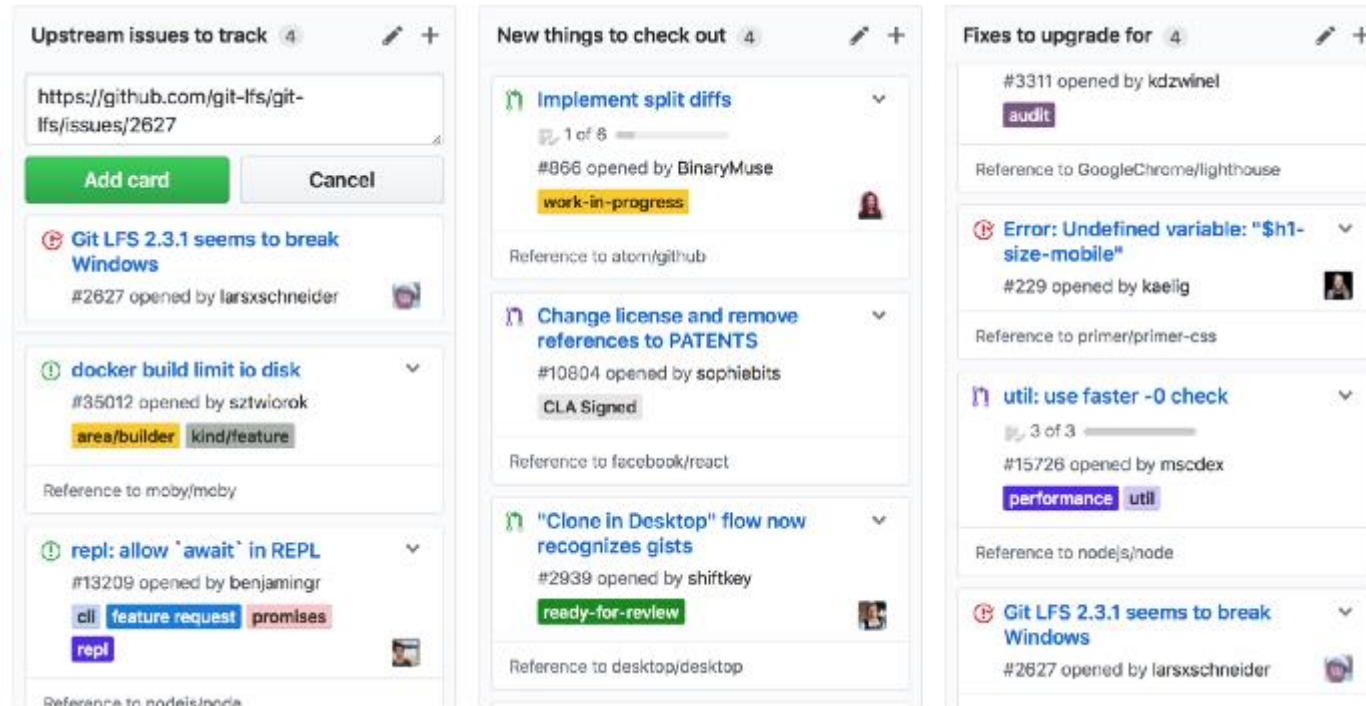
- List of those assigned to the issue
- Labels for the issue
- Projects the issue is tagged to, and its status within them

Example labels:

- enhancement: New feature or request
- bug: Something isn't working
- documentation: Improvements or additions to documentation
- duplicate: This issue or pull request already exists
- good first issue: Good for newcomers
- help wanted: Extra attention is needed
- invalid: This doesn't seem right
- question: Further information is requested

Using Github Web: Projects

Issues are collected together in Projects – like categorizations of issue (by module, type etc.)



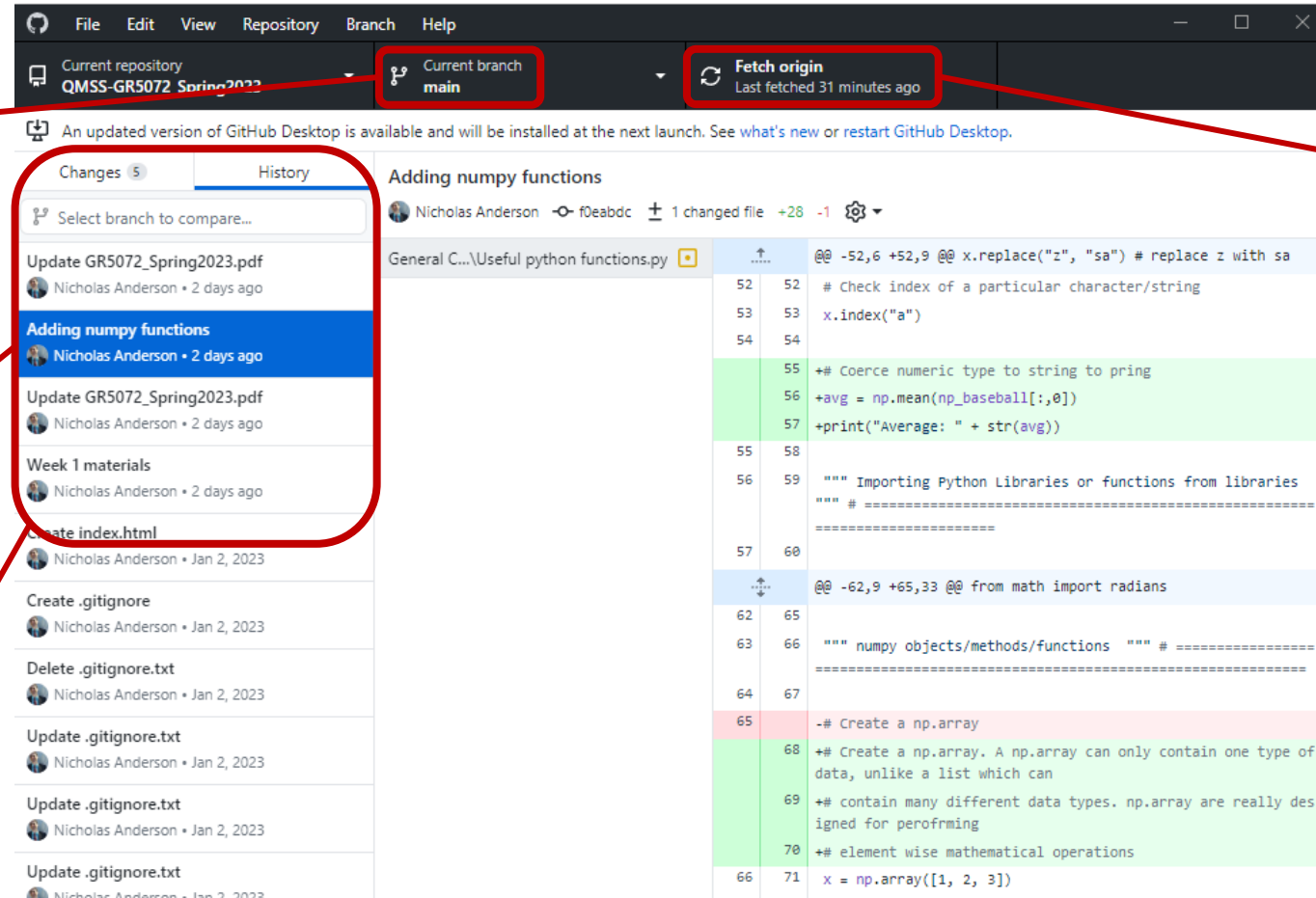
Using GitHub Desktop

You should use Github desktop to manage all things to do with making adjustments to the code (except for renaming files, which should be done in github.com)

Click to change branch – this will change all the files in your Github directory to be those from the selected branch

If you select 'history' you can see all of the commits to that branch, and see exactly what changed in each one

If you select 'changes' you can see all of the changes you have made to that branch, and commit them with a message



Click to pull the latest version of that branch from Github – you should always do this so you have the latest version

End to end process for making a change

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Making a change

Lets look at an example of the process for making a change – the following slides show screenshots of each step

- 1 Raise an issue if one isn't already created, and assign it to yourself
- 2 Move it from “To do” to “Being worked on” on the project board
- 3 Go to Github desktop, load the development branch, and click “Fetch Origin”

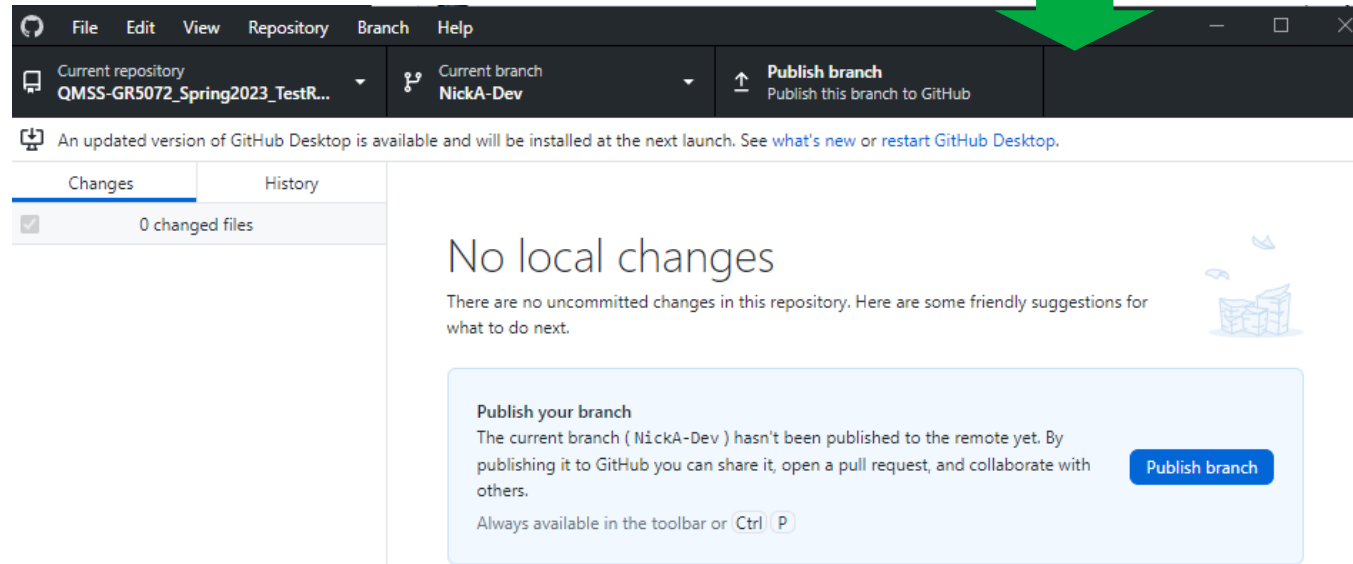
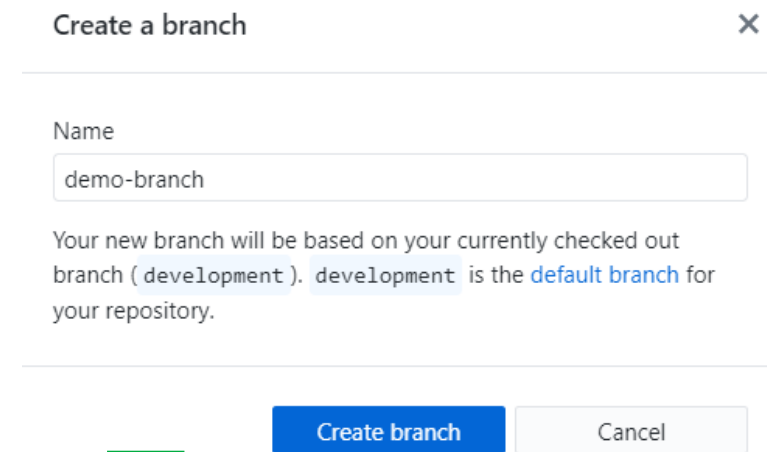
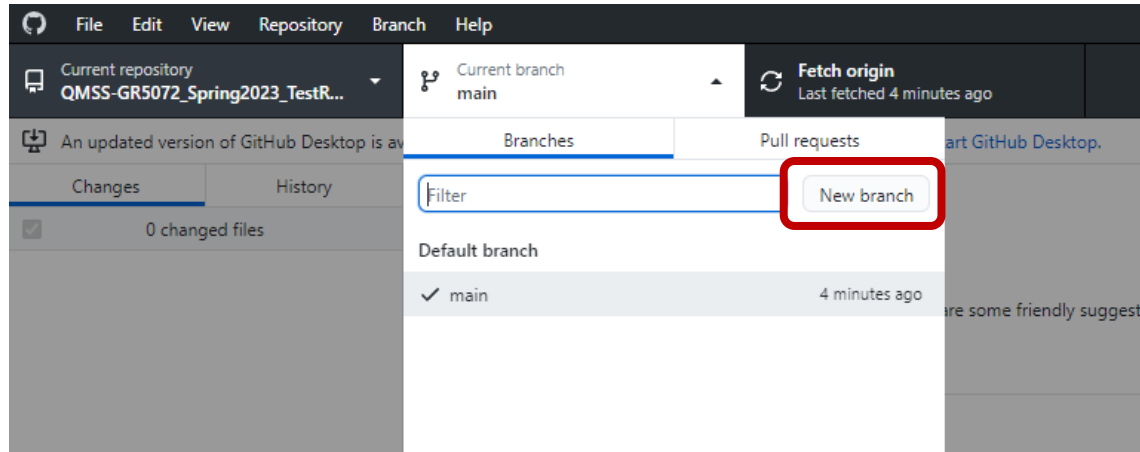
Note: These first three steps are beyond the scope of this class, but are typical steps if you are working on a large team. I therefore don't include walkthroughs on these in the subsequent slides

- 4 Create a new **branch** for your changes and load it
- 5 Make any changes you need to the code

- 6 **Commit** the changes locally in Github desktop
- 7 **Publish** your local branch to Github
- 8 Create a **pull request**
- 9 Reviewer reviews the changes, and approves (or makes comments to be addressed)
- 10 Once the merge is approved, the code is updated and the branch can be deleted

Making a change (4)

Then create a new branch with an appropriate title, and load it up



Making a change (6)

Once you've made and saved changes to a file tracked by git, go to Github Desktop and you will see the changes you've made. Click commit to add them to the branch locally, with a description

The screenshot displays the Github Desktop application interface. At the top, there are tabs for 'Changes' and 'History'. The 'Changes' tab is active, showing a list of changes under the heading '1 changed file'. A red box highlights this list, which includes 'README.md'. A callout box labeled 'List of changes that have been made' points to this list. Below the list, there is a commit message input field with a red box around it. A callout box labeled 'Add each commit with details of what has changed. This will commit it to this new branch' points to this field. To the right of the changes list, the 'README.md' file is open, showing a diff view. A red box highlights the diff, showing a new line added: '+This is an extra line added for demonstration purposes'. A callout box labeled 'Detail of changes' points to this diff view. At the bottom of the interface, there is a 'Commit to demo-branch' button.

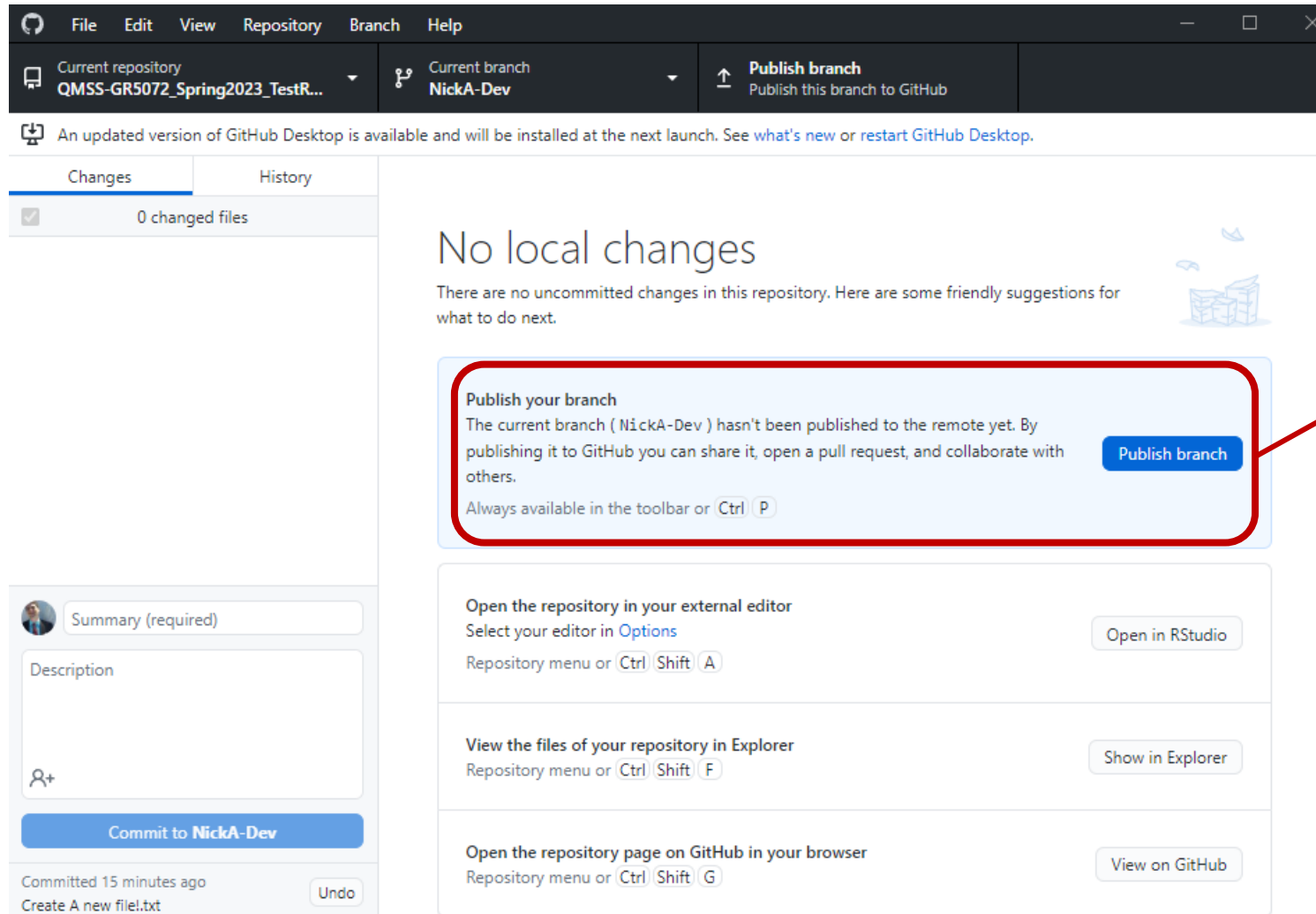
List of changes that have been made

Detail of changes

Add each commit with details of what has changed. This will commit it to this new branch

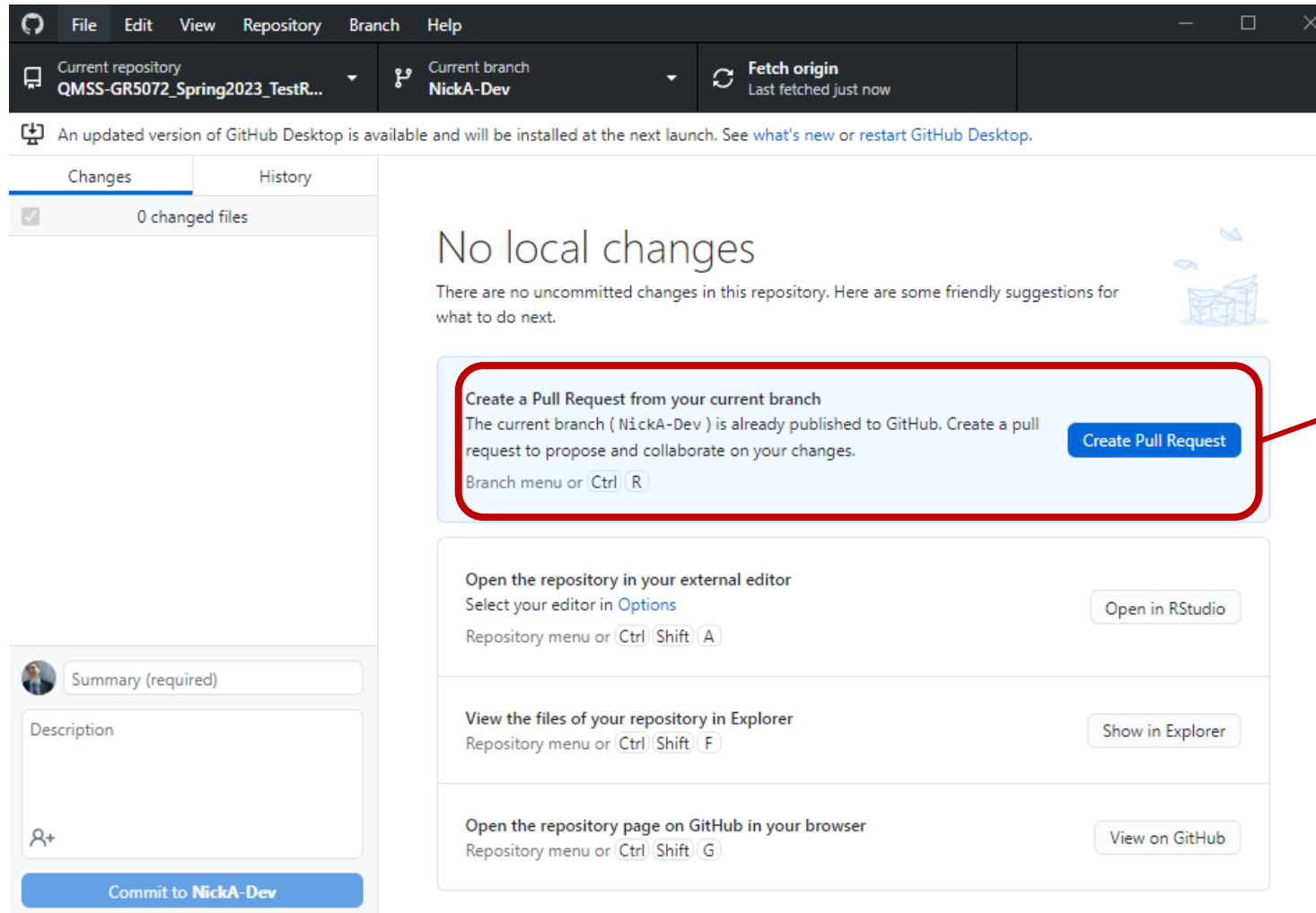
Making a change (7)

When your changes have been committed to your local branch, you need to publish that branch to Github – effectively uploading it to the central repository



Making a change (8)

Now the branch has been published to Github, you can make a pull request – a request for the branch to be merged into the main Development branch



Making a change (8)

This will open up Github web, where you can add a title and detail, as well as a reviewer and the relevant project it is for

[Code](#) [Issues](#) [Pull requests](#) [Actions](#) [Projects](#) [Wiki](#) [Security](#) [Insights](#) [Settings](#)


Open a pull request

Create a new pull request by comparing changes across two branches. If you need to, you can also [compare across forks](#).

base: main

compare: NickA-Dev

✓ Able to merge. These branches can be automatically merged.



Nick a dev

Write

Preview

Leave a comment

Attach files by dragging & dropping, selecting or pasting them.

Create pull request

Reviewers

No reviews

Assignees

No one—assign yourself

Labels

None yet

Projects

None yet

Milestone

No milestone

Development

Use [Closing keywords](#) in the description to automatically close issues

Remember, contributions to this repository should follow our [GitHub Community Guidelines](#).

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Making a change (9)

The reviewer can then go into the pull requests and select yours

The screenshot shows a GitHub Pull Request (PR) titled "Nick a dev #1". The navigation bar at the top includes links for Code, Issues, Pull requests (1), Actions, Projects, Wiki, Security, Insights, and Settings. The PR is owned by NickAnderson94 and aims to merge 2 commits into the main branch from the NickA-Dev branch. Below the PR title, there are tabs for Conversation (0), Commits (2), Checks (0), and Files changed (2). A comment from NickAnderson94 states "Adding data and an extra file!". Below the comment, a commit history shows two commits: "Update class_roster.py" (b6aa571) and "Create A new file!.txt" (0baad4a). At the bottom, a green box contains branch protection rules: "Require approval from specific reviewers before merging", "Continuous integration has not been set up", and "This branch has no conflicts with the base branch". A green button labeled "Merge pull request" is visible at the bottom left of the green box.

<> Code Issues Pull requests 1 Actions Projects Wiki Security Insights Settings

Nick a dev #1

Open NickAnderson94 wants to merge 2 commits into `main` from `NickA-Dev`

Conversation 0 Commits 2 Checks 0 Files changed 2

NickAnderson94 commented now Owner 😊 ...

Adding data and an extra file!

NickAnderson94 added 2 commits 20 minutes ago

- Update `class_roster.py` ... b6aa571
- Create A new file!.txt 0baad4a

Add more commits by pushing to the `NickA-Dev` branch on `NickAnderson94/QMSS-GR5072_Spring2023_TestRepo`.

Require approval from specific reviewers before merging Add rule ×
[Branch protection rules](#) ensure specific people approve pull requests before they're merged.

Continuous integration has not been set up
[GitHub Actions](#) and [several other apps](#) can be used to automatically catch bugs and enforce style.

This branch has no conflicts with the base branch
Merging can be performed automatically.

Merge pull request You can also [open this in GitHub Desktop](#) or view [command line instructions](#).

Making a change (9)

Who ever is managing the higher-level branch, can review the code and send feedback to who ever created the pull request

The screenshot shows a GitHub pull request page for a pull request titled "Nick a dev #1". The pull request is created by "NickAnderson94" and aims to merge 2 commits into the "main" branch from the "NickA-Dev" branch. The interface includes a navigation bar at the top with links for Code, Issues, Pull requests (1), Actions, Projects, Wiki, Security, Insights, and Settings. Below the title, there are buttons for "Open", "Edit", and "Code". A summary bar shows "Conversation 0", "Commits 2", "Checks 0", and "Files changed 2". A "Review changes" button is highlighted with a red box. The file list on the left shows "Programs" with two files: "A new file!.txt" and "class_roster.py". The diff view for "Programs/class_roster.py" shows a change on line 14, where a new line is added: "class_roster.append('Mr. Anderson')".

Nick a dev #1

Open NickAnderson94 wants to merge 2 commits into main from NickA-Dev

Conversation 0 Commits 2 Checks 0 Files changed 2

Changes from all commits File filter Conversations 0

0 / 2 files viewed

Review changes

Programs/A new file!.txt

Empty file.

Programs/class_roster.py

```
@@ -11,7 +11,7 @@
11 11 # to the class_roster list! Make sure your code is added above the print statement!
12 12
13 13 class_roster.append("Nick Anderson")
14 -
14 + class_roster.append("Mr. Anderson")
15 15
16 16
17 17
```

Review changes here

Making a change (9)

They can then see all the changes, and add any comments they want

The screenshot shows a GitHub Pull Request titled "Nick a dev #1" by user NickAnderson94. The interface includes a navigation bar with links to Code, Issues, Pull requests (1), Actions, Projects, Wiki, Security, Insights, and Settings. Below the title, there's a green "Open" button and a summary: "NickAnderson94 wants to merge 2 commits into main from NickA-Dev". A progress bar shows 0 conversations, 2 commits, 0 checks, and 2 files changed. A search bar for "Filter changed files" is on the left. The file list on the left shows "Programs" expanded with "A new file!.txt" and "class_roster.py". The diff view for "Programs/class_roster.py" shows a change on line 14. The change is highlighted with a green background and a red box around the "+" sign in the diff notation. The diff shows a new line of code: `class_roster.append("Mr. Anderson")`. A blue box with a red arrow points to the "+" sign in the diff notation, containing the text: "Click or drag at the side to add comments to the code".

Code Issues Pull requests 1 Actions Projects Wiki Security Insights Settings

Nick a dev #1

Edit Code

Open NickAnderson94 wants to merge 2 commits into main from NickA-Dev

Conversation 0 Commits 2 Checks 0 Files changed 2 +1 -1

Changes from all commits File filter Conversations 0 / 2 files viewed Review changes

Filter changed files

Programs

- A new file!.txt
- class_roster.py

Programs/A new file!.txt Viewed

Empty file.

Programs/class_roster.py Viewed

```
@@ -11,7 +11,7 @@
11 11 # to the class_roster list! Make sure your code is added above the print statement!
12 12
13 13 class_roster.append("Nick Anderson")
14 14 class_roster.append("Mr. Anderson")
15 15
16 16
17 17
```

Click or drag at the side to add comments to the code

Making a change (9)

They can then submit their review with any comments – either submitting it with feedback to be addressed, or approving it all and merging it

The screenshot displays a GitHub Pull Request page for a user named 'Nick a dev #1'. The pull request is titled 'NickAnderson94 wants to merge 2 commits into main from NickA-Dev'. The interface shows a list of files changed, including 'Programs/A new file!.txt' and 'Programs/class_roster.py'. The 'class_roster.py' file is selected, showing a diff view with changes to the 'class_roster.append' function. A review comment is being written, stating 'This is not a student!'. The comment box includes a text area, a file attachment area, and buttons for 'Cancel', 'Add single comment', and 'Start a review'.

Navigation: <> Code Issues Pull requests 1 Actions Projects Wiki Security Insights Settings

Nick a dev #1

[Open](#) NickAnderson94 wants to merge 2 commits into `main` from `NickA-Dev`

Conversation 0 Commits 2 Checks 0 Files changed 2 +1 -1

Changes from all commits File filter Conversations 0 / 2 files viewed [Review changes](#)

Filter changed files

- Programs
 - A new file!.txt
 - class_roster.py

Programs/A new file!.txt

Empty file.

Programs/class_roster.py

```
@@ -11,7 +11,7 @@
11 11 # to the class_roster list! Make sure your code is added above the print statement!
12 12
13 13 class_roster.append("Nick Anderson")
14 -
14 + class_roster.append("Mr. Anderson")
```

Write Preview

This is not a student!

Attach files by dragging & dropping, selecting or pasting them.

[Cancel](#) [Add single comment](#) [Start a review](#)

15 15
16 16
17 17

Making a change (9)

This will update the pull request with the review comments, and the pull request can be merged or sent back for revision

The screenshot displays a GitHub Pull Request (PR) titled "Nick a dev #1" by user NickAnderson94. The PR aims to merge 2 commits into the 'main' branch from the 'NickA-Dev' branch. The interface includes a top navigation bar with links for Code, Issues, Pull requests (1), Actions, Projects, Wiki, Security, Insights, and Settings. Below the title, there are buttons for 'Open', 'Edit', and 'Code'. The PR details show 0 conversations, 2 commits, 0 checks, and 2 files changed. A 'Finish your review' button is visible in the top right. On the left, a sidebar shows the file structure with 'Programs' containing 'A new file!.txt' and 'class_roster.py'. The main area displays a diff for 'Programs/class_roster.py', showing changes to lines 11 through 17. A review comment by NickAnderson94 is visible, stating "This is not a student!". A 'Finish your review' modal is open, showing options to 'Comment', 'Approve', or 'Request changes'. A 'Submit review' button is at the bottom of the modal. In the bottom left corner, a green box contains a checklist of requirements for merging, including 'Require approval from specific reviewers before merging', 'Continuous integration has not been set up', and 'This branch has no conflicts with the base branch'. A 'Merge pull request' button is also present.

Code Issues Pull requests 1 Actions Projects Wiki Security Insights Settings

Nick a dev #1

Open NickAnderson94 wants to merge 2 commits into main from NickA-Dev

Conversation 0 Commits 2 Checks 0 Files changed 2 +1 -1

Changes from all commits File filter Conversations 0 / 2 files viewed Finish your review 1

Filter changed files

- Programs
 - A new file!.txt
 - class_roster.py

Empty file.

Programs/class_roster.py

@@ -11,7 +11,7 @@

```
11 11 # to the class_roster list!
12 12
13 13 class_roster.append("Nick Anderson")
14 -
14 + class_roster.append("Mr. Anderson")
```

NickAnderson94 Pending 1

This is not a student!

Reply...

15 15
16 16
17 17

Finish your review

Write Preview H B I `< > @`

Leave a comment

Attach files by dragging & dropping, selecting or pasting them.

☒ Comment Submit general feedback without explicit approval.

☐ Approve Submit feedback and approve merging these changes.

☐ Request changes Submit feedback that must be addressed before merging.

Submit review 1 pending comment

Require approval from specific reviewers before merging
Branch protection rules ensure specific people approve pull requests before they're merged. Add rule X

Continuous integration has not been set up
GitHub Actions and several other apps can be used to automatically catch bugs and enforce style.

✓ This branch has no conflicts with the base branch
Merging can be performed automatically.

2 Merge pull request You can also open this in GitHub Desktop or view command line instructions.

