

# Introduction

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## What is Git?

Git is a popular version control system. It was created by Linus Torvalds in 2005, and has been maintained by Junio Hamano since then.

It is used for:

- Tracking code changes
- Tracking who made changes
- Coding collaboration

## What is usually done using Git

- Initialize Git on a folder, making it a Repository
- Git now creates a hidden folder to keep track of changes in that folder
- When a file is changed, added or deleted, it is considered modified
- You select the modified files you want to Stage
- The Staged files are Committed, which prompts Git to store a permanent snapshot of the files
- Git allows you to see the full history of every commit.
- You can revert back to any previous commit.
- Git does not store a separate copy of every file in every commit, but keeps track of changes made in each commit!

## Why Git?



- Over 70% of developers use Git!
- Developers can work together from anywhere in the world.
- Developers can see the full history of the project.
- Developers can revert to earlier versions of a project.

## How Git actually works !

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### GitHub

- the largest host of source code in the world, and has been owned by Microsoft since 2018.
  - It's not the same as Git but it uses Git.
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## Installation

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### Git

#### Linux

```
sudo apt update
sudo apt install git
```

#### Windows

[Download Git](#)

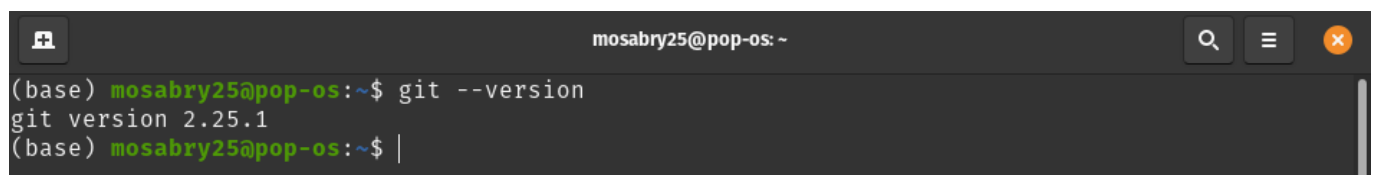
### GitHub Desktop

[Linux](#)

[Windows](#)

#### Check installation from Git version

```
git --version
```

A terminal window screenshot with a dark background. The title bar shows 'mosabry25@pop-os: ~'. The prompt is '(base) mosabry25@pop-os:~\$'. The command 'git --version' has been entered and executed, resulting in the output 'git version 2.25.1'. The prompt is now '(base) mosabry25@pop-os:~\$ |' with a cursor.

```
(base) mosabry25@pop-os:~$ git --version
git version 2.25.1
(base) mosabry25@pop-os:~$ |
```

### Configure Git

Use **global** to set the username and e-mail for every repository on your computer.

```
git config --global user.name "Muhammad Sabry"
git config --global user.email "test@gmail.com"
```

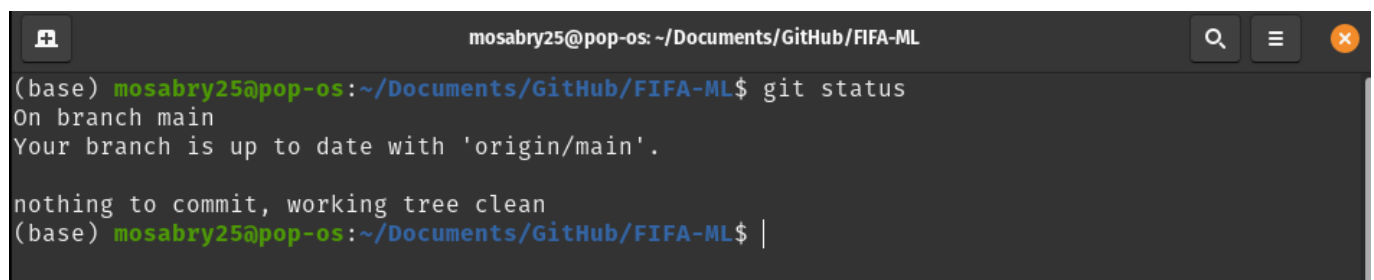
## Creating Git Folder

```
mkdir GP
cd GP
git init
```

## Git status

To check for any changes in the tracked directory.

```
git status
```

A terminal window screenshot with a dark background. The title bar shows 'mosabry25@pop-os: ~/Documents/GitHub/FIFA-ML'. The command prompt is '(base) mosabry25@pop-os:~/Documents/GitHub/FIFA-ML\$'. The command entered is 'git status'. The output is: 'On branch main', 'Your branch is up to date with \'origin/main\'.', 'nothing to commit, working tree clean'. The prompt is now '(base) mosabry25@pop-os:~/Documents/GitHub/FIFA-ML\$ |'.

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## Git Staging Environment

- adding single file.

```
git add script.py
```

- Adding more than one file using regex.

```
git add *.png
```

The previous command will add all unstaged pictures with png extension in the current directory.

- Adding all changes.

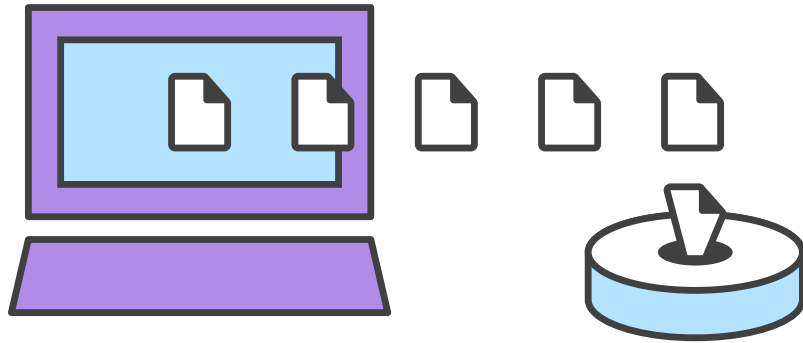
```
git add --all
git add -A
git add .
```

Using **--all** instead of individual filenames will **stage** all changes (new, modified, and deleted) files.

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## Git Stash

Temporarily shelves changes you've made to your working copy so you can work on something else, and then come back and re-apply them later.



- Stashing Unstaged changes.

```
git stash -u
```

```
MoSabry25 GitLocal 🌱 main
• > git status
On branch main
Your branch is up to date with 'origin/main'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
      pics/hero.svg

nothing added to commit but untracked files present (use "git add" to track)

MoSabry25 GitLocal 🌱 main 📄 ×1
• > git stash -u
Saved working directory and index state WIP on main: 904188b Updating pdf

MoSabry25 GitLocal 🌱 main 📦
• > git status
On branch main
Your branch is up to date with 'origin/main'.

nothing to commit, working tree clean

MoSabry25 GitLocal 🌱 main 📦
• > git stash apply
Already up to date!
On branch main
Your branch is up to date with 'origin/main'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
      pics/hero.svg

nothing added to commit but untracked files present (use "git add" to track)
```

- Stashing Staged changes.

```
git stash
```

```
MoSabry25 GitLocal 🌱 main 📁 ×1
• > git status
On branch main
Your branch is up to date with 'origin/main'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
      pics/hero.svg

nothing added to commit but untracked files present (use "git add" to track)

MoSabry25 GitLocal 🌱 main 📁 ×1
• > git add pics/hero.svg

MoSabry25 GitLocal 🌱 main 📁 ×1
• > git stash
Saved working directory and index state WIP on main: 904188b Updating pdf

MoSabry25 GitLocal 🌱 main 📁
• > git status
On branch main
Your branch is up to date with 'origin/main'.

nothing to commit, working tree clean

MoSabry25 GitLocal 🌱 main 📁
• > git stash pop
On branch main
Your branch is up to date with 'origin/main'.

Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
      new file:   pics/hero.svg

Dropped refs/stash@{0} (735e38a7e8702770615260a1a1d41bab3762b1d5)

MoSabry25 GitLocal 🌱 main 📁 ×1
• > git status
On branch main
Your branch is up to date with 'origin/main'.

Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
```

- Bringing back Stashed work.

```
git stash pop
```

Popping your stash removes the changes from your stash and reapplies them to your working copy.

- Alternatively, you can reapply the changes to your working copy and keep them in your stash.

```
git stash apply
```

- Manging multiple Stashes.

```
git stash list
```

- Adding a message to the stash.

```
git stash save "A brief message"
```

- Popping a specific Stash form Stash list.

```
git stash pop stash@{index}
```

```
MoSabry25 GitLocal 🌱 main 📦 📁 ×1
• > git stash save "Removing unwanted pics"
Saved working directory and index state On main: Removing unwanted pics

MoSabry25 GitLocal 🌱 main 📦
• > git stash list
stash@{0}: On main: Removing unwanted pics
stash@{1}: WIP on main: b5d0d63 Saving before stash list

MoSabry25 GitLocal 🌱 main 📦
• > git stash pop stash@{1}
Already up to date!
On branch main
Your branch is up to date with 'origin/main'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
    pics/Screenshot from 2022-09-21 02-23-20.png

nothing added to commit but untracked files present (use "git add" to track)
Dropped stash@{1} (50c027f7d5c9bfa32bdd41b2445b8986a28b73f7)
```

- Dropping a specific Stash.

```
git stash drop stash@{index}
```

```
MoSabry25 GitLocal 🌱 main 📦
• > git stash list
stash@{0}: WIP on main: b5d0d63 Saving before stash list
stash@{1}: On main: Removing unwanted pics

MoSabry25 GitLocal 🌱 main 📦
• > git stash drop stash@{0}
Dropped stash@{0} (c8c542351511529f12ee30fcb494d11ab869bbc8)

MoSabry25 GitLocal 🌱 main 📦
• > git stash list
stash@{0}: On main: Removing unwanted pics
```

- To clear your Stash.

```
git stash clear
```

```
MoSabry25 GitLocal 🌱 main 📦 ×1
• > git stash
Saved working directory and index state WIP on main: 904188b Updating pdf

MoSabry25 GitLocal 🌱 main 📦
• > git stash clear

MoSabry25 GitLocal 🌱 main
⊗ > git stash pop
No stash entries found.

MoSabry25 GitLocal 🌱 main
○ > 
```

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## Git Commit

Since we have finished our work, we are ready to move from **stage** to **commit** for our repo.

- Adding commits keep track of our progress and changes as we work. Git considers each commit change point or "save point".
- When we commit, we must include a message (**Mandatory**).

```
git commit -m "A brief Message"
```

The **commit** command performs a commit, and the **-m "message"** adds a message.



```
(base) mosabry25@pop-os:~/Documents/test$ git add --all
(base) mosabry25@pop-os:~/Documents/test$ git commit -m "first file added"
[master (root-commit) 231bb2e] first file added
1 file changed, 1 insertion(+)
create mode 100644 1.txt
```

- Adding **Description** with the Commit Message.

```
git commit -m "A brief Message" -m "Description ....."
```

## Git Commit with Stage

```
git status
git commit -am "A brief message"
```

The **-am** allows us to add and message at the same time.

**Note:** to use -am you must check the status first and it's working with already added files not new created ones.

## Git Commit without Stage

Check the status of our repository. But this time, we will use the --short option to see the changes in a more compact way:

```
git status --short
```

- ?? - Untracked files
- A - Files added to stage
- M - Modified files
- D - Deleted files

**Skipping Staging Environment is not generally recommended.**

## Git Commit Log

Allows us to view the history of commits for a repository.

```
git log
```

```
mosabry25@pop-os: ~/Documents/GitHub/FIFA-ML
(base) mosabry25@pop-os:~/Documents/GitHub/FIFA-ML$ git log
commit 3c3e4a0b5b788abd0d9ef033fe2b8a8e5a591e90 (HEAD -> main, origin/main, origin/HEAD)
Author: Mazen Mohamed Bakr <71599149+IX0XI@users.noreply.github.com>
Date: Mon May 23 03:58:04 2022 +0200

    Conclusion Updated

commit 07d907b43bbf0f07d24ec18475fbd9e906dc203c
Author: WaleedMohamed0 <91630222+WaleedMohamed0@users.noreply.github.com>
Date: Mon May 23 03:34:40 2022 +0200

    Report Added, Testing time for each Model

commit 45b99af4dbd25295038b31744ea4f574d3e82502
Author: WaleedMohamed0 <91630222+WaleedMohamed0@users.noreply.github.com>
Date: Mon May 23 03:33:45 2022 +0200

    Report added, Testing time for each Model

commit eb57b2419ecc15b62158d19f69de66548af265d5
Author: Mazen Mohamed Bakr <71599149+IX0XI@users.noreply.github.com>
Date: Sun May 22 22:28:22 2022 +0200

    final with negative R2

commit f6e39d89a0d36b48c4850f2dfec89619edc70a85
Author: WaleedMohamed0 <91630222+WaleedMohamed0@users.noreply.github.com>
Date: Sun May 22 15:46:50 2022 +0200

    SVM, DecisionTree Added

commit 41fb78c8b26af506195973c72107493abe5d8c7e
Author: WaleedMohamed0 <91630222+WaleedMohamed0@users.noreply.github.com>
Date: Sun May 22 04:32:15 2022 +0200

    SVM, DecisionTree Added

commit b5286d95527463ffa717d06fcc7b038acf8941ea
Author: Mazen Mohamed Bakr <71599149+IX0XI@users.noreply.github.com>
Date: Sun May 22 02:15:38 2022 +0200

    Classification preprocessing/ Logistic Regression

commit a2abcfdc74fbb6f60b5a51ed9fbff1c58d562651
Author: Muhammad Sabry <85039719+MuhammadS25@users.noreply.github.com>
Date: Thu Apr 21 01:16:39 2022 +0200
```

To avoid the very long log list, it's better to use **--oneline** displaying every commit with it's **hash** and **message**.

```
git log --oneline
```

```

mosabry25@pop-os: ~/Documents/GitHub/FIFA-ML
(base) mosabry25@pop-os:~/Documents/GitHub/FIFA-ML$ git log --oneline
3c3e4a0 (HEAD -> main, origin/main, origin/HEAD) Conclusion Updated
07d907b Report Added, Testing time for each Model
45b99af Report added, Testing time for each Model
eb57b24 final with negative R2
f6e39d8 SVM, DecisionTree Added
41fb78c SVM, DecisionTree Added
b5286d9 Classification preprocessing/ Logistic Regression
a2abcfcd Update workspace.xml
fca6da7 Update workspace.xml
d2755ff Formatting Code
110c9ca Separate MultiVariable Regression into a file of its own
bc99bce Separate Polynomial Regression into file
25ff2e4 Adding Correlation and top feature to preprocessing
df259ce Divide Preprocessing into separate file
df4d3e2 little adjustment to conclusion
fe88c6c Reviewed Report and added conclusion
f5fbc79 Report Added

```

## Git diff

It simply displays the changes between two commits

```
git diff #commit1hash #commit2hash
```

Note: change the order of the commits affects the result as it displays the changes from **commit1** and **commit2**.

```

mosabry25@pop-os: ~/Documents/GitHub/FIFA-ML
(base) mosabry25@pop-os:~/Documents/GitHub/FIFA-ML$ git log --oneline
3c3e4a0 (HEAD -> main, origin/main, origin/HEAD) Conclusion Updated
07d907b Report Added, Testing time for each Model
45b99af Report added, Testing time for each Model
eb57b24 final with negative R2
f6e39d8 SVM, DecisionTree Added
41fb78c SVM, DecisionTree Added
b5286d9 Classification preprocessing/ Logistic Regression
a2abcfcd Update workspace.xml
fca6da7 Update workspace.xml
d2755ff Formatting Code
110c9ca Separate MultiVariable Regression into a file of its own
bc99bce Separate Polynomial Regression into file
25ff2e4 Adding Correlation and top feature to preprocessing
df259ce Divide Preprocessing into separate file
df4d3e2 little adjustment to conclusion
fe88c6c Reviewed Report and added conclusion
f5fbc79 Report Added
dcc866a File Updated
(base) mosabry25@pop-os:~/Documents/GitHub/FIFA-ML$ git diff 45b99af 07d907b
diff --git a/Report2.docx b/Report2.docx
new file mode 100644
index 0000000..96b91cb
Binary files /dev/null and b/Report2.docx differ
(base) mosabry25@pop-os:~/Documents/GitHub/FIFA-ML$ |

```

---

## Git Branch

A **Branch** is a new/separate version of the main repository.

Using **Branches** allows you:

- Working on a new version without impacting the live version
- Creating a new branch to fix small errors then merge it to the live version.
- divide the work between more than one person working on independent units.
- You can switch between different **Branches** and work on them without impacting each other.

### Creating New Branch

```
git branch NewBranchName
```

### To check on Created Branches

```
git branch
NewBranch
* master
```

the **\*** refers to that we are currently on that **Branch**.

### To navigate between **Branches**

```
git checkout NewBranch #Old Command
git switch NewBranch
```

```
(base) mosabry25@pop-os:~/Documents/test$ git checkout NewBranch
Switched to branch 'NewBranch'
```

That command switches us to **NewBranch**.

```
git checkout -b MyNewBranch
```

Using **-b** on **checkout** will create a new **branch** if it doesn't exist then it will navigate to the new created **branch**.

## Merge Branches

First we need to navigate to our destination branch which will have the merged version and it's usually the **master branch**.

Then we **merge** the master branch with NewBranch.

```
git checkout master  
git merge NewBranch
```

Since we finished the work on **NewBranch** we can delete it.

```
git branch -d Newbranch
```

```
(base) mosabry25@pop-os:~/Documents/test$ git branch -d newbranch  
Deleted branch newbranch (was 231bb2e).
```

## Merge Conflicts

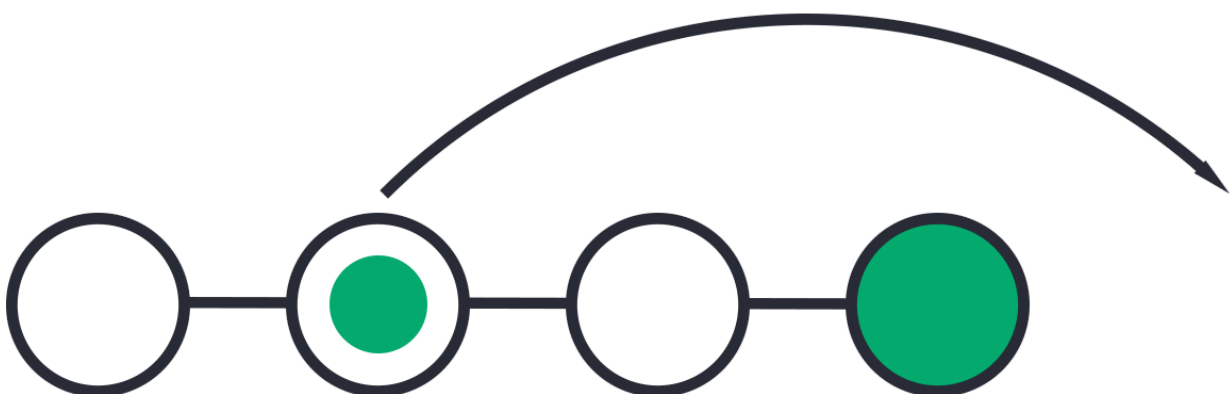
Merge Conflict happens when there's two versions of the same file in the master and the other branch due to **commits on the destination branch** to fix the conflict we edit the file with the conflict **in the destination branch** then we run **git commit** that will conclude the **merge**.

---

## Git Revert

This Command is used when we want to take a previous commit as a new commit.

1. Find that previous commit.
2. Calculate the number of steps.
3. Make it the new commit.



```
git log --oneline
```

If it's the previous commit

```
git revert HEAD --no-edit
```

Adding **--no-edit** to replace the commit message with default revert message.

To **revert** to an earlier commit, use **HEAD~x** where **x** refers (**Number of steps -1**).

```
git revert HEAD~2 --no-edit
```

It will make the 3rd previous commit the new one.



---

## Git Reset

**reset** is the command we use to move the repository to an earlier commit without making new commits.

1. Find that previous commit.
2. Get that **commithash**
3. Move the repository back to it.

```
git log --oneline
```

Get the hash, then

```
git reset 9a9add8
```

## Git Undo Reset

Even if the following commits are no longer displayed in the log but they still exist.

Store the **commithash** before applying the reset so you can get back to any commit.

```
git reset e56ba1f
```

So **reset** could be used to go backward or forward.

## Git Amend

It combines the latest staging changes with the latest commit as a **new commit** replacing the old one.

Usually used to change the latest commit message.

```
git commit --amend -m "New message"
```

## Git ignore

.gitignore file allows us to ignore the changes of specific files as it uses regex to ignore this group of files and folders.

1. After intializing the repository, create **.gitignore** file.
2. Adding the regex of wanted untracked files.

Note: Search in google for the .gitignore file for the programming language that will be used in that project, copy it then paste in the created **.gitignore** file.

```
nano .gitignore
```

## Rules for .gitignore

Here are the general rules for matching patterns in **.gitignore** files:

Pattern	Explanation/Matches	Examples
	Blank lines are ignored	
<i># text comment</i>	Lines starting with # are ignored	
<i>name</i>	All <i>name</i> files, <i>name</i> folders, and files and folders in any <i>name</i> folder	/name.log /name/file.txt /lib/name.log
<i>name/</i>	Ending with / specifies the pattern is for a folder. Matches all files and folders in any <i>name</i> folder	/name/file.txt /name/log/name.log  <b>no match:</b> /name.log
<i>name.file</i>	All files with the <i>name.file</i>	/name.file /lib/name.file
<i>/name.file</i>	Starting with / specifies the pattern matches only files in the root folder	/name.file  <b>no match:</b> /lib/name.file
<i>lib/name.file</i>	Patterns specifying files in specific folders are always relative to root (even if you do not start with /)	/lib/name.file  <b>no match:</b> name.file

		/test/lib/name.file
**/lib/name.file	Starting with ** before / specifies that it matches any folder in the repository. Not just on root.	/lib/name.file /test/lib/name.file
**/name	All <i>name</i> folders, and files and folders in any <i>name</i> folder	/name/log.file /lib/name/log.file /name/lib/log.file
/lib/**/name	All <i>name</i> folders, and files and folders in any <i>name</i> folder within the lib folder.	/lib/name/log.file /lib/test/name/log.file /lib/test/ver1/name/log.file  <b>no match:</b> /name/log.file
*.file	All files with the .file extension	/name.file /lib/name.file
*name/	All folders ending with <i>name</i>	/lastname/log.file /firstname/log.file
name?.file	? matches a <b>single</b> non-specific character	/names.file /name1.file  <b>no match:</b> /names1.file
name[a-z].file	[range] matches a <b>single</b> character in the specified range (in this case a character in the range of a-z, and also be numeric.)	/names.file /nameb.file  <b>no match:</b> /name1.file
name[abc].file	[set] matches a <b>single</b> character in the specified set of characters (in this case either a, b, or c)	/namea.file /nameb.file  <b>no match:</b> /names.file
name[!abc].file	[!set] matches a <b>single</b> character, <b>except</b> the ones specified in the set of characters (in this case a, b, or c)	/names.file /namex.file  <b>no match:</b> /namesb.file
*.file	All files with the .file extension	/name.file /lib/name.file
name/ !name/secret.log	! specifies a negation or exception. Matches all files and folders in any <i>name</i> folder, except name/secret.log	/name/file.txt /name/log/name.log  <b>no match:</b> /name/secret.log
*.file !name.file	! specifies a negation or exception. All files with the .file extension, except name.file	/log.file /lastname.file  <b>no match:</b> /name.file
*.file !name/*.file junk.*	Adding new patterns after a negation will re-ignore a previous negated file All files with the .file extension, except the ones in <i>name</i> folder. Unless the file name is junk	/log.file /name/log.file  <b>no match:</b> /name/junk.file



## Local and Personal Git Ignore Rules

It is also possible to ignore files or folders but not show it in the distributed `.gitignore` file.

These kinds of ignores are specified in the `.git/info/exclude` file. It works the same way as `.gitignore` but are not shown to anyone else.

## Finally a Cheat Sheet with Extra Information

### Git Cheat Sheet

#### Setup

Set the name and email that will be attached to your commits and tags

```
$ git config --global
user.name "Danny Adams"
$ git config --global
user.email "my-
email@gmail.com"
```

#### Start a Project

Create a local repo (omit <directory> to initialise the current directory as a git repo)

```
$ git init <directory>
Download a remote repo
$ git clone <url>
```

#### Make a Change

Add a file to staging

```
$ git add <file>
```

Stage all files

```
$ git add .
```

Commit all staged files to git

```
$ git commit -m "commit
message"
```

Add all changes made to tracked files & commit

```
$ git commit -am "commit
message"
```

#### Basic Concepts

**main**: default development branch  
**origin**: default upstream repo  
**HEAD**: current branch  
**HEAD^**: parent of HEAD  
**HEAD~4**: great-great grandparent of HEAD

*By @DoableDanny*

#### Branches

List all local branches. Add -r flag to show all remote branches. -a flag for all branches.

```
$ git branch
```

Create a new branch

```
$ git branch <new-branch>
```

Switch to a branch & update the working directory

```
$ git checkout <branch>
```

Create a new branch and switch to it

```
$ git checkout -b <new-branch>
```

Delete a merged branch

```
$ git branch -d <branch>
```

Delete a branch, whether merged or not

```
$ git branch -D <branch>
```

Add a tag to current commit (often used for new version releases)

```
$ git tag <tag-name>
```

#### Merging

Merge branch a into branch b. Add --no-ff option for no-fast-forward merge

```
$ git merge b
```

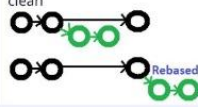
```
$ git merge a
```

Merge & squash all commits into one new commit

```
$ git merge --squash a
```

#### Rebasing

Rebase feature branch onto main (to incorporate new changes made to main). Prevents unnecessary merge commits into feature, keeping history clean



```
$ git checkout feature
$ git rebase main
```

Iteratively clean up a branches commits before rebasing onto main

```
$ git rebase -i main
```

Iteratively rebase the last 3 commits on current branch

```
$ git rebase -i HEAD~3
```

#### Undoing Things

Move (&/or rename) a file & stage move

```
$ git mv <existing_path>
<new_path>
```

Remove a file from working directory & staging area, then stage the removal

```
$ git rm <file>
```

Remove from staging area only

```
$ git rm --cached <file>
```

View a previous commit (READ only)

```
$ git checkout <commit_ID>
```

Create a new commit, reverting the changes from a specified commit

```
$ git revert <commit_ID>
```

Go back to a previous commit & delete all commits ahead of it (revert is safer). Add --hard flag to also delete workspace changes (BE VERY CAREFUL)

```
$ git reset <commit_ID>
```

#### Review your Repo

List new or modified files not yet committed

```
$ git status
```

List commit history, with respective IDs

```
$ git log --oneline
```

Show changes to unstaged files. For changes to staged files, add --cached option

```
$ git diff
```

Show changes between two commits

```
$ git diff commit1_ID
commit2_ID
```

#### Stashing

Store modified & staged changes. To include untracked files, add -u flag. For untracked & ignored files, add -a flag.

```
$ git stash
```

As above, but add a comment.

```
$ git stash save "comment"
```

Partial stash. Stash just a single file, a collection of files, or individual changes from within files

```
$ git stash -p
```

List all stashes

```
$ git stash list
```

Re-apply the stash without deleting it

```
$ git stash apply
```

Re-apply the stash at index 2, then delete it from the stash list. Omit stash@{n} to pop the most recent stash.

```
$ git stash pop stash@{2}
```

Show the diff summary of stash 1. Pass the -p flag to see the full diff.

```
$ git stash show stash@{1}
```

Delete stash at index 1. Omit stash@{n} to delete last stash made

```
$ git stash drop stash@{1}
```

Delete all stashes

```
$ git stash clear
```

#### Synchronizing

Add a remote repo

```
$ git remote add <alias>
<url>
```

View all remote connections. Add -v flag to view urls.

```
$ git remote
```

Remove a connection

```
$ git remote remove <alias>
```

Rename a connection

```
$ git remote rename <old>
<new>
```

Fetch all branches from remote repo (no merge)

```
$ git fetch <alias>
```

Fetch a specific branch

```
$ git fetch <alias> <branch>
```

Fetch the remote repo's copy of the current branch, then merge

```
$ git pull
```

Move (rebase) your local changes onto the top of new changes made to the remote repo (for clean, linear history)

```
$ git pull --rebase <alias>
```

Upload local content to remote repo

```
$ git push <alias>
```

Upload to a branch (can then pull request)

```
$ git push <alias> <branch>
```

## Git Help

To see all possible commands.

```
git help --all
```

Or through

[Git Online Danny Page](#)

## Resources

[w3schools](#)

[Programming with Mosh](#)

[Missing Semester](#)

[Bitbucket](#)