GIT AND GITHUB

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VERSION CONTROL SYSTEMS

Version control helps in managing multiple versions of documents, programs, etc.

- Used universally in most organizations for real time project management
- Essential for collaborative team projects

Scenario 1 (personal project)	Scenario 2 (team project)

• You wrote a story
• Now you want to write two different climaxes of the same story (git branch)
• Get both climaxes reviewed
• Add the most acceptable climax to the main story (git merge)
• Delete the other climax (git branch –d)
	• Writing a feature extraction code for segmented objects
	• You are working in a team
	  • Neeraj is coding for texture features
	  • Ruchika is coding for shape features
	• Both programmers make changes to local copy of the main code
	  • Later review the changes and merge them with the main code

WHY VERSION CONTROL?

For working by yourself:

- Gives you a "time machine" for going back to earlier versions
- Gives you great support for different versions of the same basic project

For working with others:

- Greatly simplifies concurrent work, merging changes

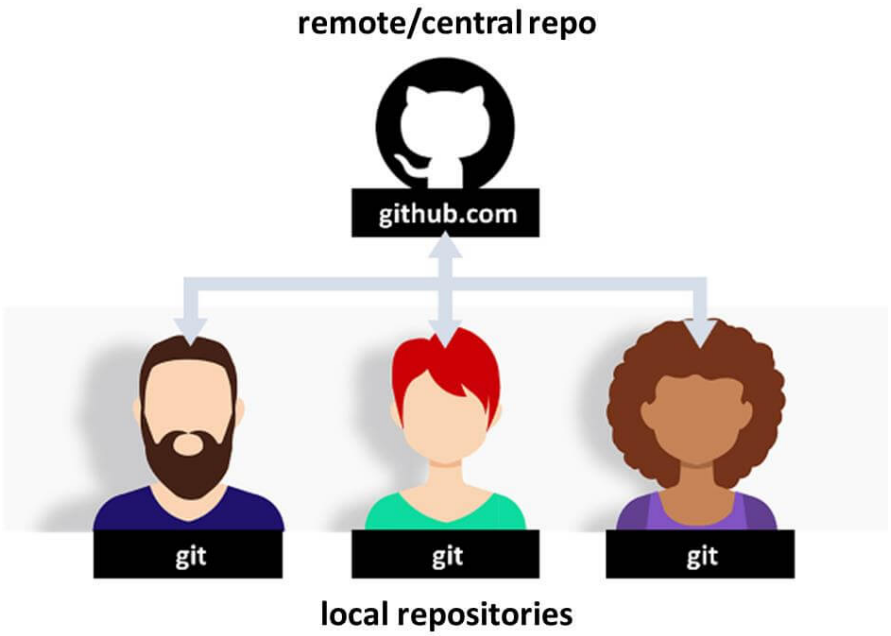
For getting an internship or job:

- Any company with a clue uses some kind of version control
- Companies without a clue are bad places to work

Adapted from: https://www.cis.upenn.edu/~matuszek/cit591-2012/index.html

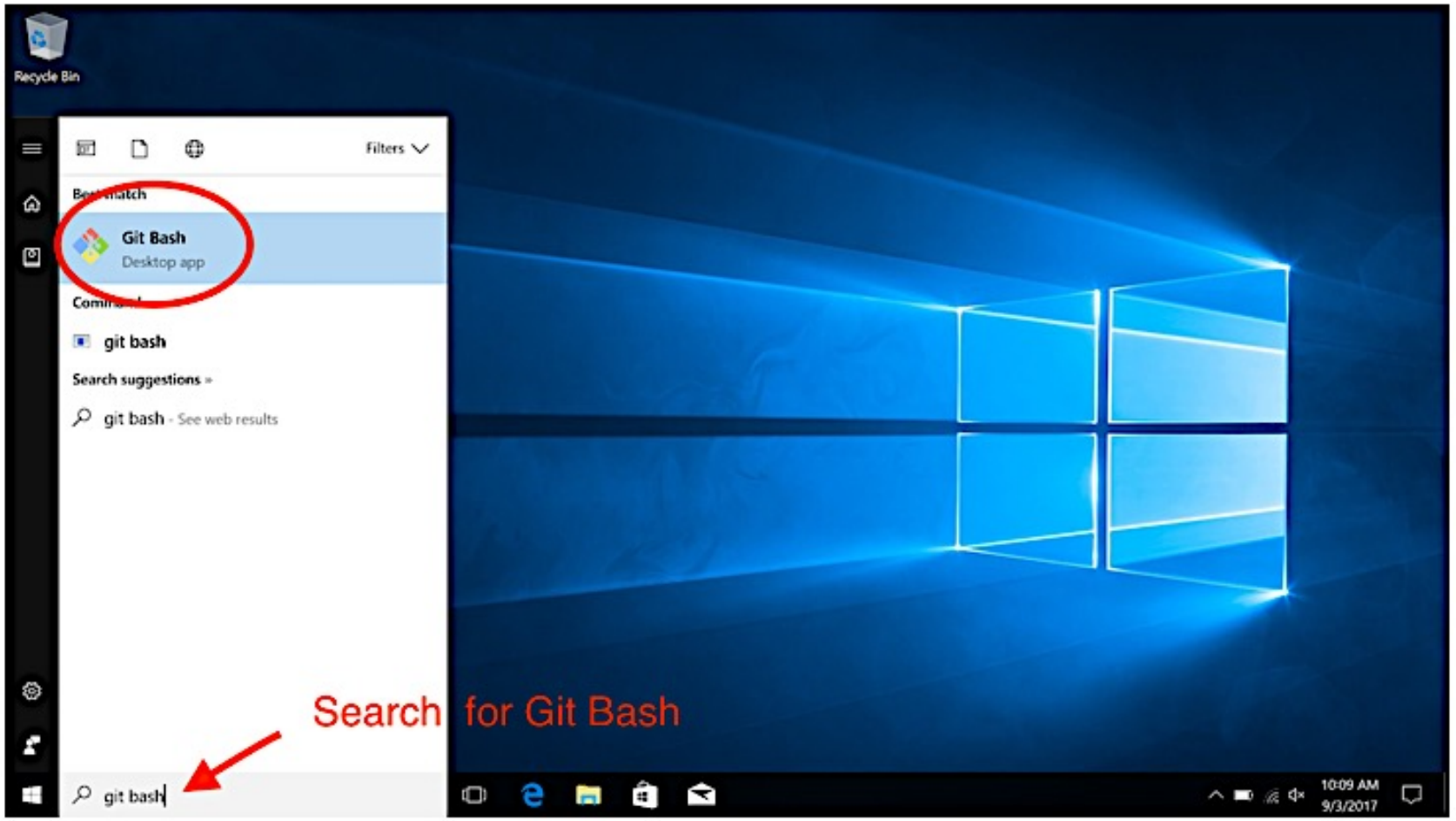
WHAT IS GIT AND GITHUB?

- Git is a free and open source distributed version control system designed to track changes to source code during software development.
  - But can be used to track changes in any set of files
- GitHub is a web-based Git repository hosting service



GETTING STARTED

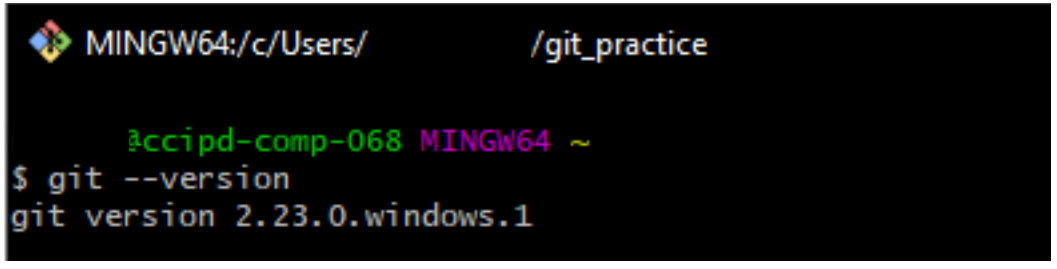
- Download Git Bash from the following link
  - gitforwindows.org
- Open git bash as shown



GIT COMMAND LINE

Check version of the git installed using the following command

git --version



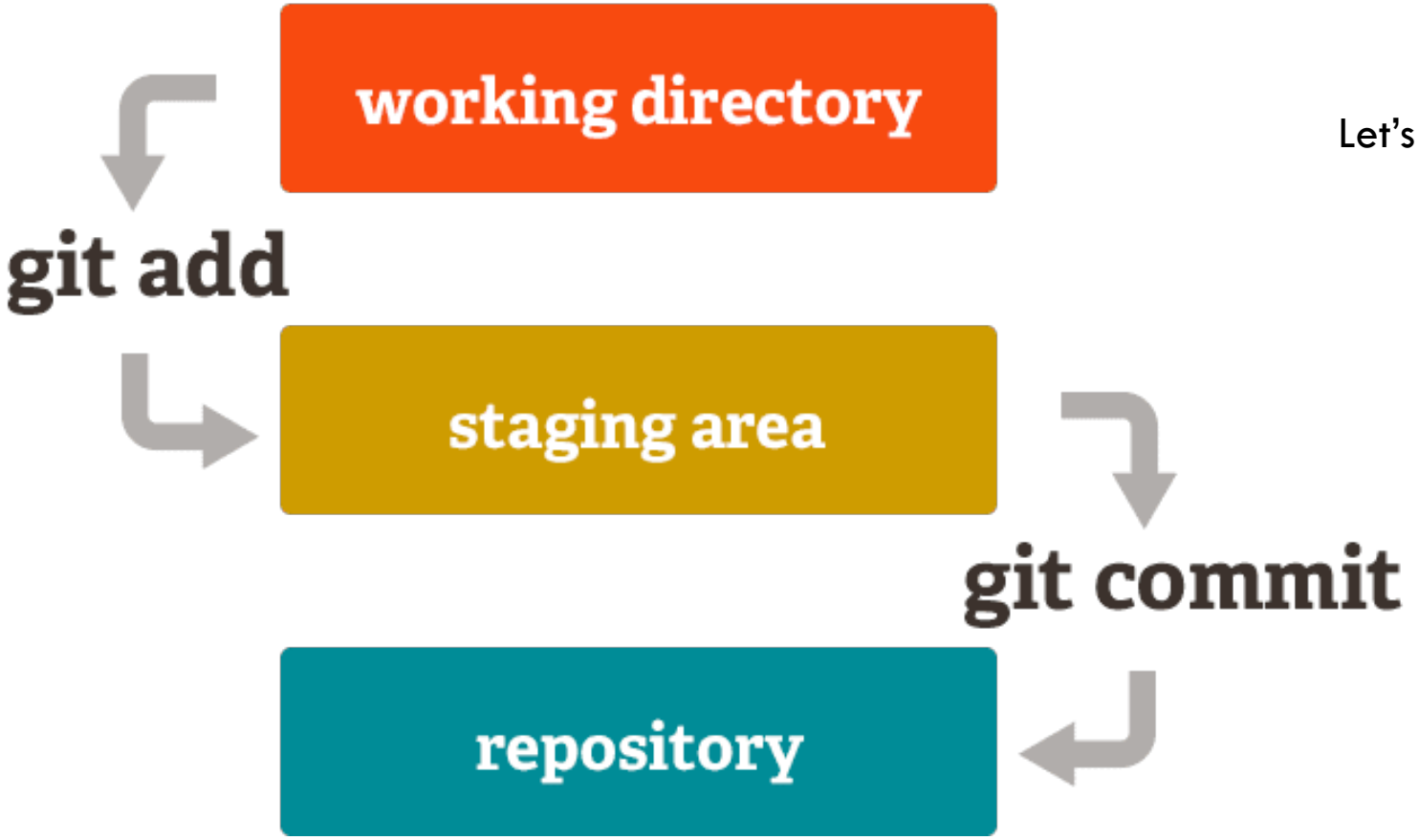
INTRODUCE YOURSELF TO GIT

- Set git username for every repository on your computer
  - git config --global user.name “Mona Lisa”
- Set git email for every repository on your computer
  - git config --global user.email xyz@server.com
- Confirm that the user name and email are set up correctly
  - git config user.name
  - git config user.email
- Want to use a different user name and email for a specific project?
  - cd project_directory
  - Use git config commands, without the –-global

CREATING GIT REPOSITORY

- Move to the desired working directory using cd
  - cd D:\
- Create a new directory to practice git skills
  - mkdir git_practice
- cd git_practice to make the new directory your working directory
- git init to turn the current directory into a fresh git repository
- echo “Hello Git and GitHub” >> README.txt to create a new readme file with some text

GIT WORKFLOW

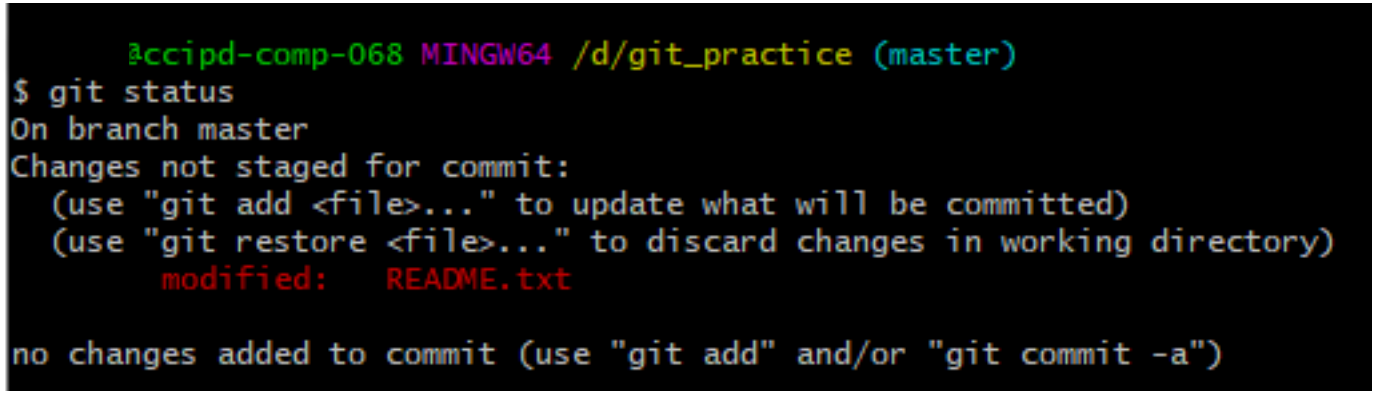


Let's try committing our readme

- git add README.txt
  Ignore LF warning, if it appears
- git commit -m "First Commit"

GIT TRACKS CHANGES

- Open README.txt file in a text editor and enter the following line
  - Warning: You must read this file before proceeding!
- Save the README.txt file and return to Git Bash
- git status checks the status of the tracked files and also displays untracked files



GIT DIFF

- git diff shows the changes that are not staged yet

```
      @ccipd-comp-068 MINGW64 /d/git_practice (master)
$ git diff
warning: LF will be replaced by CRLF in README.txt.
The file will have its original line endings in your working directory
diff --git a/README.txt b/README.txt
index 41f3533..426f9e5 100644
--- a/README.txt
+++ b/README.txt
@@ -1 +1,3 @@
 Hello Git and GitHub
+
+Warning: You must read this file before proceeding!
\ No newline at end of file
```

- git add README.txt
- git commit -m “Warning added to readme file.”

GIT LOG

- git log shows a running log of commits
- A full log has the following pieces
  - A commit hash (SHA)
  - Commit author metadata- name and email address of the commit author
  - Commit date metadata- a date time stamp
  - Commit message- what the commit was about

```
      ccipd-comp-068 MINGW64 /d/git_practice (master)
$ git log
commit f87c09ed87b1ee55c64f19ab9a36bc1ffc4bd42f (HEAD -> master)
Author: Neeraj Kumar <24767040+neerajkumarvaid@users.noreply.github.com>
Date:   Sun Nov 3 19:04:31 2019 -0500

    Warning added to readme file.

commit a298edc4d5c7e6af1b341f17508232c4707afb5d
Author: Neeraj Kumar <24767040+neerajkumarvaid@users.noreply.github.com>
Date:   Sun Nov 3 18:50:50 2019 -0500

    First Commit
```

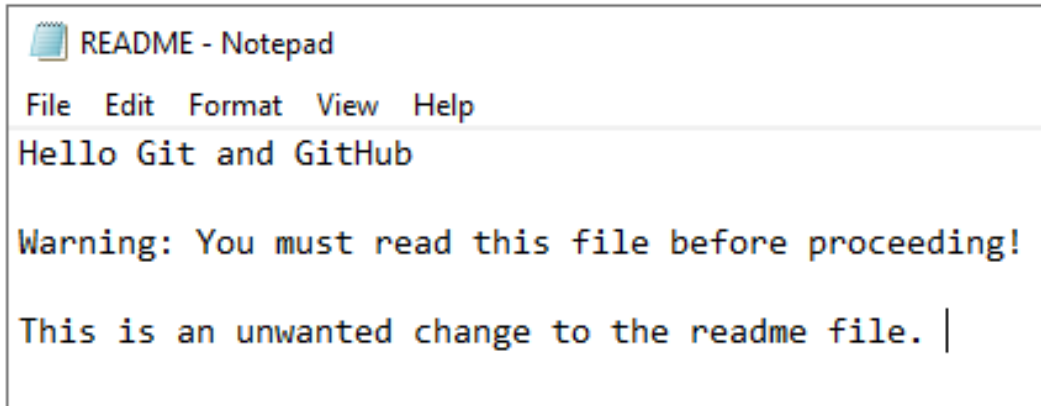
BACKTRACKING I

- The commit you are currently on is known as the HEAD commit.
  - git show HEAD

```
      @ccipd-comp-068 MINGW64 /d/git_practice (master)
$ git show HEAD
commit f87c09ed87b1ee55c64f19ab9a36bc1ffc4bd42f (HEAD -> master)
Author: Neeraj Kumar <24767040+neerajkumarvaid@users.noreply.github.com>
Date:   Sun Nov 3 19:04:31 2019 -0500

    Warning added to readme file.

diff --git a/README.txt b/README.txt
index 41f3533..426f9e5 100644
--- a/README.txt
+++ b/README.txt
@@ -1 +1,3 @@
 Hello Git and GitHub
+
+Warning: You must read this file before proceeding!
\ No newline at end of file
```

BACKTRACKING II

- Open README.txt and add the following line.
  - This is an unwanted change to the readme file.
- Save and close README.txt file.



- git checkout HEAD README.txt will restore the file.
- Open README.txt again.

BACKTRACKING III

- Accidently added changed file to staging area.
- git reset HEAD filename unstages the files before a commit.
- Open README.txt and add the following line.
  - This is an unwanted change to the readme file.
- Save and close README.txt file.
- git status (check the status of git repository)
- git add README.txt (adds file to the staging area)
- git status (check the status of git repository)
- git reset HEAD README.txt (unstages the file)
- git status (check the status of git repository)
- git checkout HEAD README.txt (restores file to last commit)

```
        cipd-comp-068 MINGW64 /d/git_practice (master)
$ git status
On branch master
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   README.txt

no changes added to commit (use "git add" and/or "git commit -a")

        cipd-comp-068 MINGW64 /d/git_practice (master)
$ git add README.txt

        cipd-comp-068 MINGW64 /d/git_practice (master)
$ git status
On branch master
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        modified:   README.txt


        cipd-comp-068 MINGW64 /d/git_practice (master)
$ git reset HEAD README.txt
Unstaged changes after reset:
M       README.txt

        cipd-comp-068 MINGW64 /d/git_practice (master)
$ git status
On branch master
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   README.txt

no changes added to commit (use "git add" and/or "git commit -a")

        cipd-comp-068 MINGW64 /d/git_practice (master)
$ git checkout HEAD README.txt
Updated 1 path from daef8d6
```

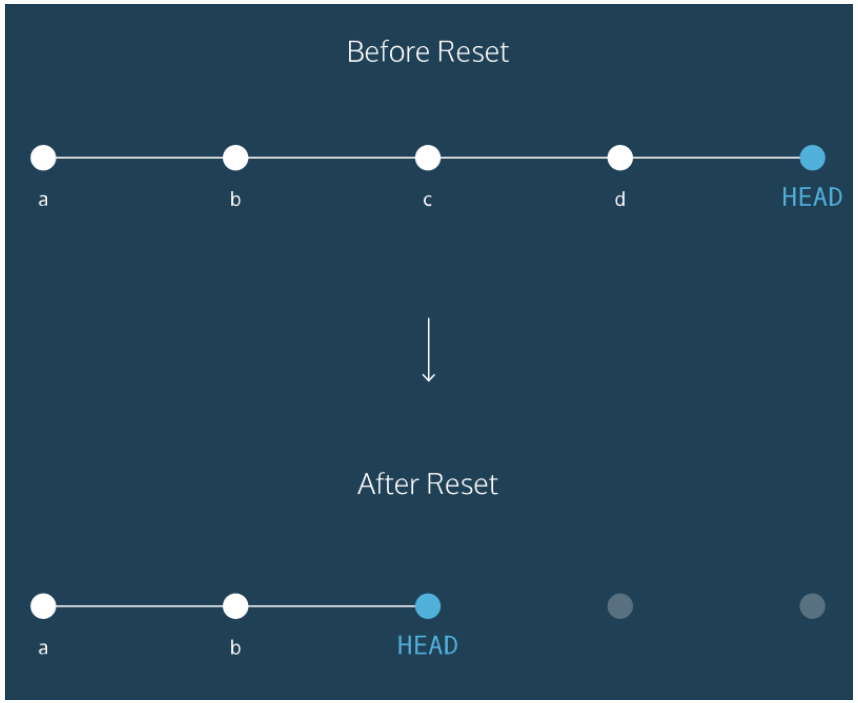
BACKTRACKING IV

- Accidently made a commit of file changes.
- git reset commit_SHA restores file to previous commit.
- Add the following line to README.txt and save it.
  - This is an unwanted change to the readme file.
- git add README.txt
- git commit –m “Unwanted line added.”
- git log (see the HEAD commit)
- git reset f87c09e (first 7 characters of commit SHA)
- git log (see the HEAD commit)
- git checkout HEAD README.txt (restores the file)

```
pd-comp-068 MINGW64 /d/git_practice (master)
$ git add README.txt

pd-comp-068 MINGW64 /d/git_practice (master)
$ git commit -m "Unwanted line added."
[master c0b8733] Unwanted line added.
 1 file changed, 3 insertions(+), 1 deletion(-)

pd-comp-068 MINGW64 /d/git_practice (master)
$ git log
commit c0b8733438c586649f9ab6f7334ad388ae033c23 (HEAD -> master)
Author: Neeraj Kumar <24767040+neerajkumarvaid@users.noreply.github.com>
Date:   Sun Nov 3 21:29:37 2019 -0500

    Unwanted line added.

commit f87c09ed87b1ee55c64f19ab9a36bc1ffc4bd42f
Author: Neeraj Kumar <24767040+neerajkumarvaid@users.noreply.github.com>
Date:   Sun Nov 3 19:04:31 2019 -0500

    Warning added to readme file.

commit a298edc4d5c7e6af1b341f17508232c4707afb5d
Author: Neeraj Kumar <24767040+neerajkumarvaid@users.noreply.github.com>
Date:   Sun Nov 3 18:50:50 2019 -0500

    First Commit

pd-comp-068 MINGW64 /d/git_practice (master)
$ git reset fa7c09e
fatal: ambiguous argument 'fa7c09e': unknown revision or path not in the working tree.
Use '--' to separate paths from revisions, like this:
'git <command> [<revision>...] -- [<file>...]'

pd-comp-068 MINGW64 /d/git_practice (master)
$ git reset f87c09e
Unstaged changes after reset:
M       README.txt

pd-comp-068 MINGW64 /d/git_practice (master)
$ git show HEAD
commit f87c09ed87b1ee55c64f19ab9a36bc1ffc4bd42f (HEAD -> master)
Author: Neeraj Kumar <24767040+neerajkumarvaid@users.noreply.github.com>
Date:   Sun Nov 3 19:04:31 2019 -0500

    Warning added to readme file.

diff --git a/README.txt b/README.txt
index 41f3533..426f9e5 100644
--- a/README.txt
+++ b/README.txt
@@ -1 +1,3 @@
 Hello Git and GitHub
+
+Warning: You must read this file before proceeding!
\ No newline at end of file

pd-comp-068 MINGW64 /d/git_practice (master)
$ git checkout HEAD README.txt
Updated 1 path from daef8d6
```

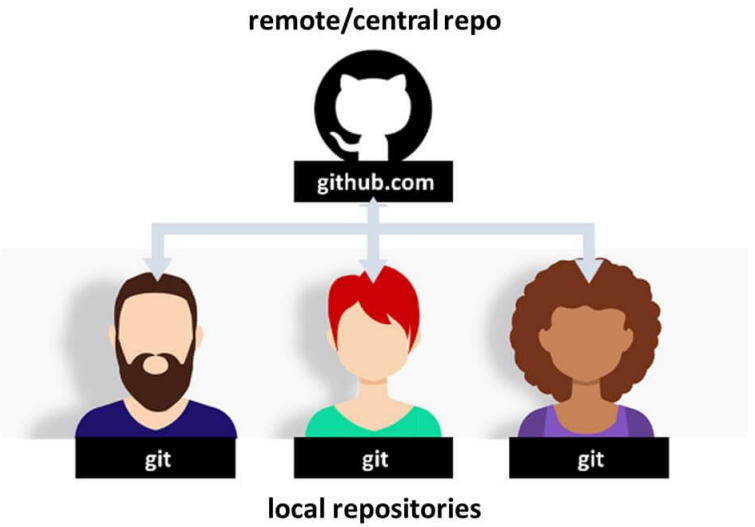
BACKTRACKING SUMMARY

- git checkout HEAD filename discards changes made in the working directory
- git reset HEAD filename unstages the file from the staging area
- git reset commit_SHA resets to a previous commit in your commit history.



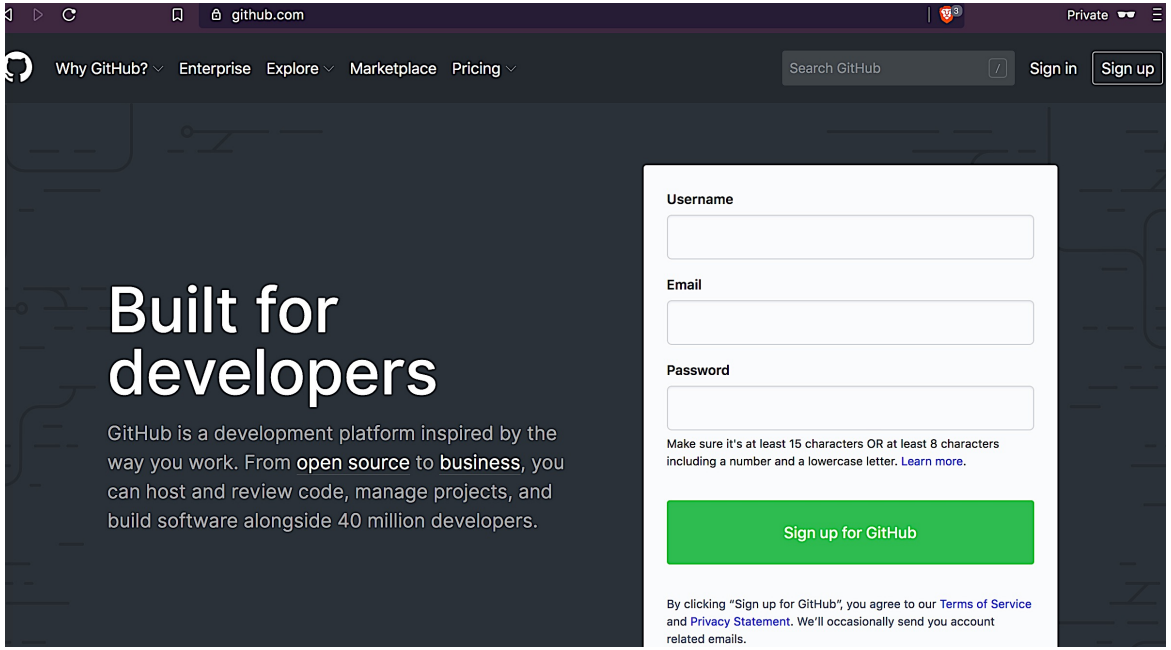
WHAT IS GIT AND GITHUB?

- GitHub is a web-based Git repository hosting service
- Allows collaborative development
- Allows you to know who made the changes and when
- Allows you to revert any changes and go back to a previous state

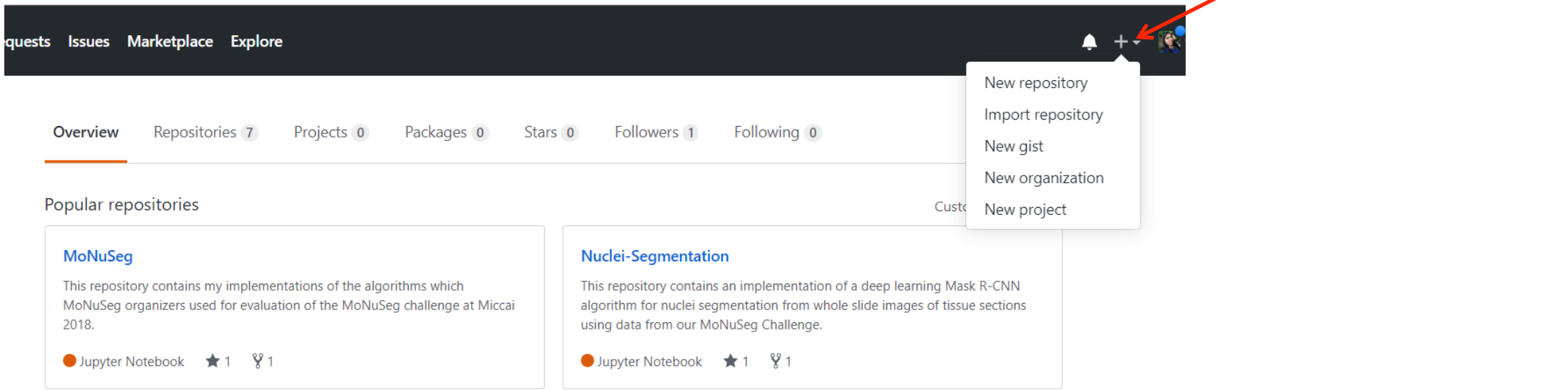


GITHUB

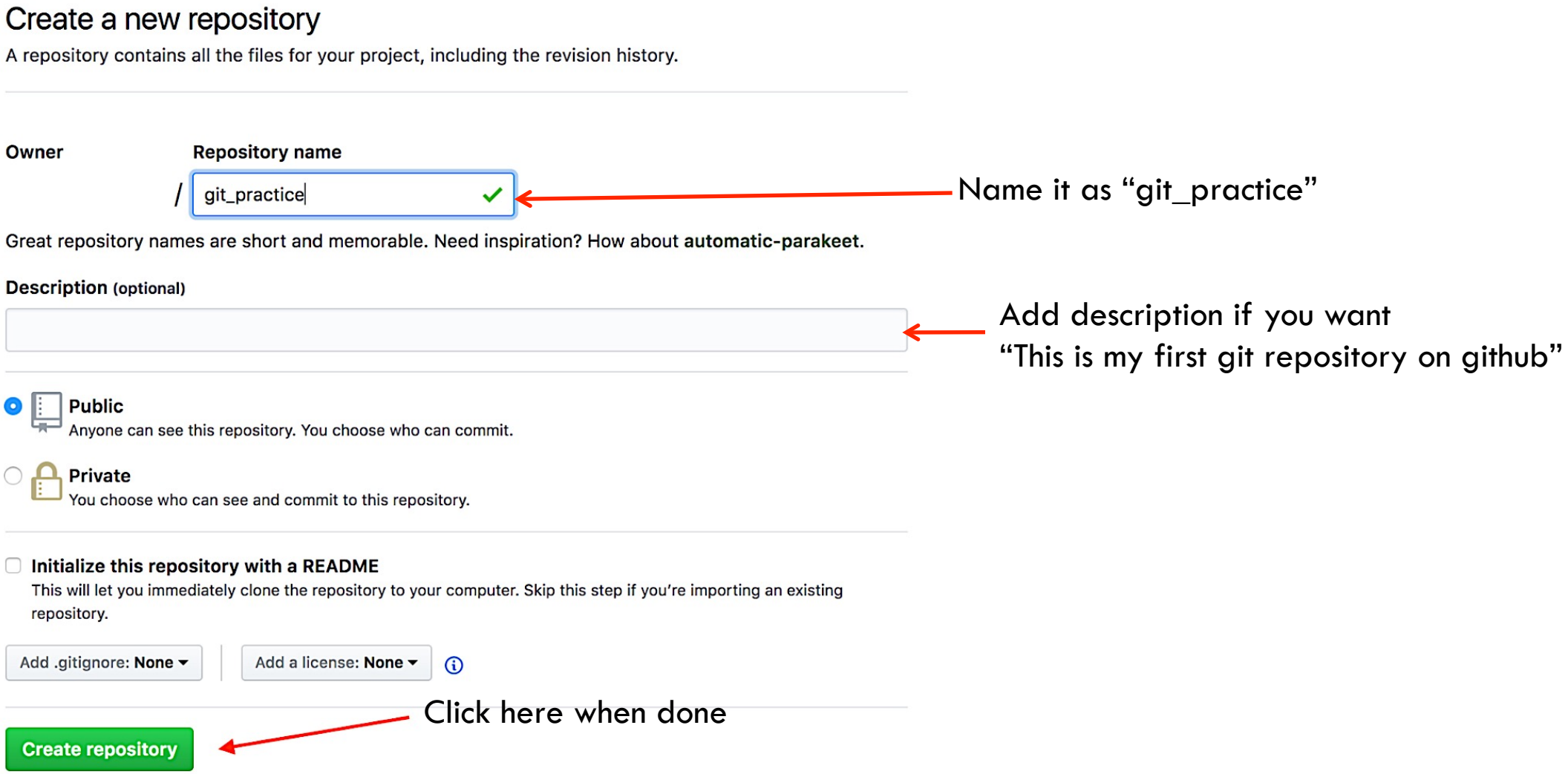
- Creating an account on github.com
  - If you already have an account, just log in to it



- Create a new repository on github by clicking on the '+' sign



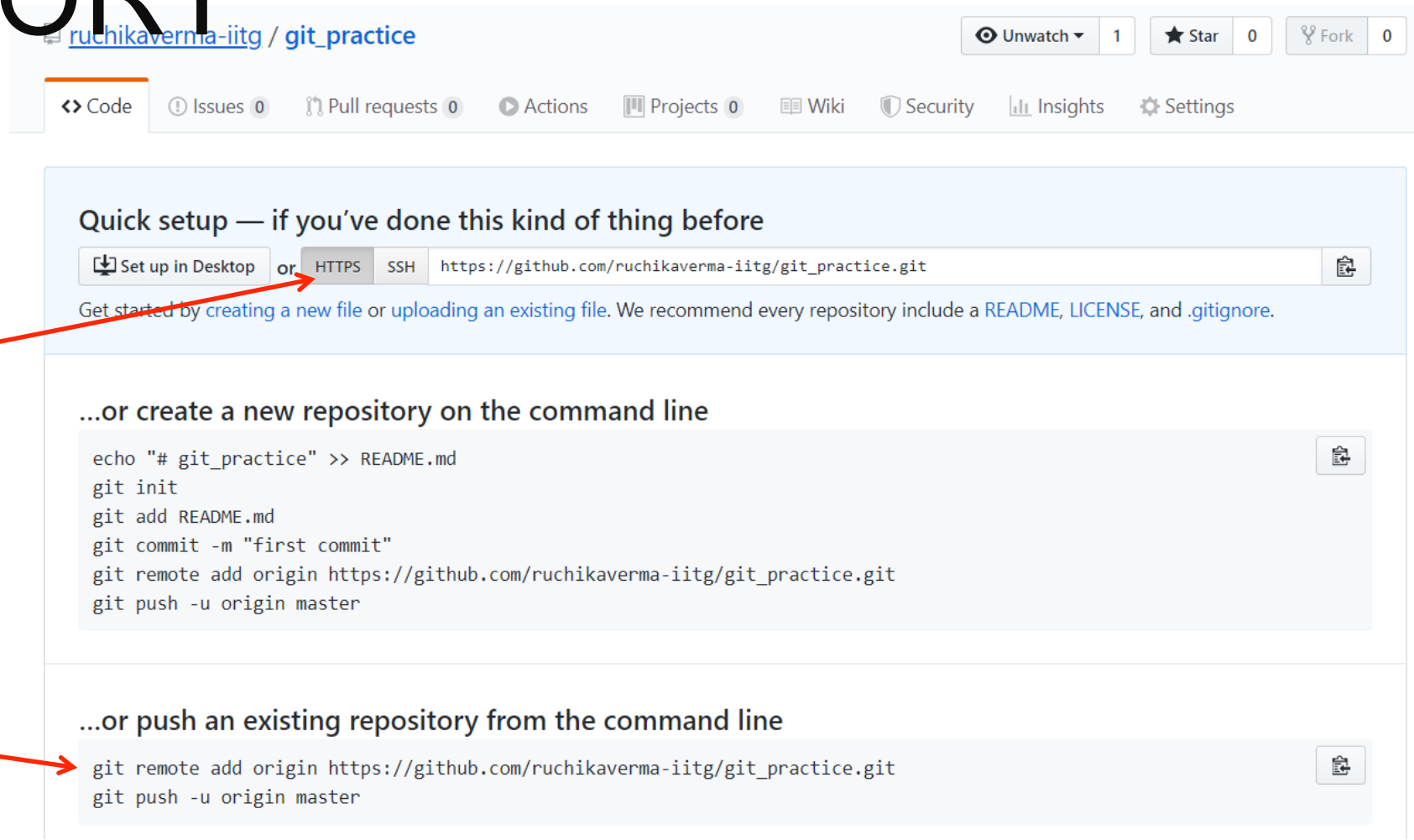
GITHUB REPOSITORY



LOCAL TO GITHUB REPOSITORY

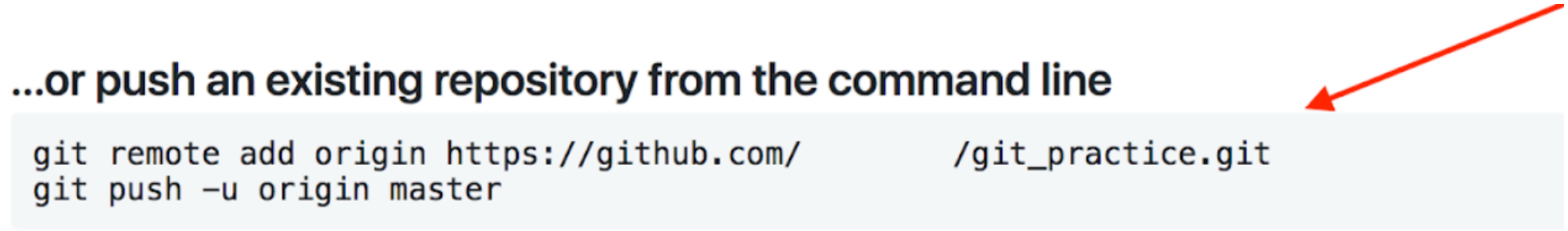
Make sure that 'https' is selected

Use these commands to push files from your local git repository to this github repository



LOCAL TO GITHUB

- Copy following two commands from GitHub and paste in Git Bash

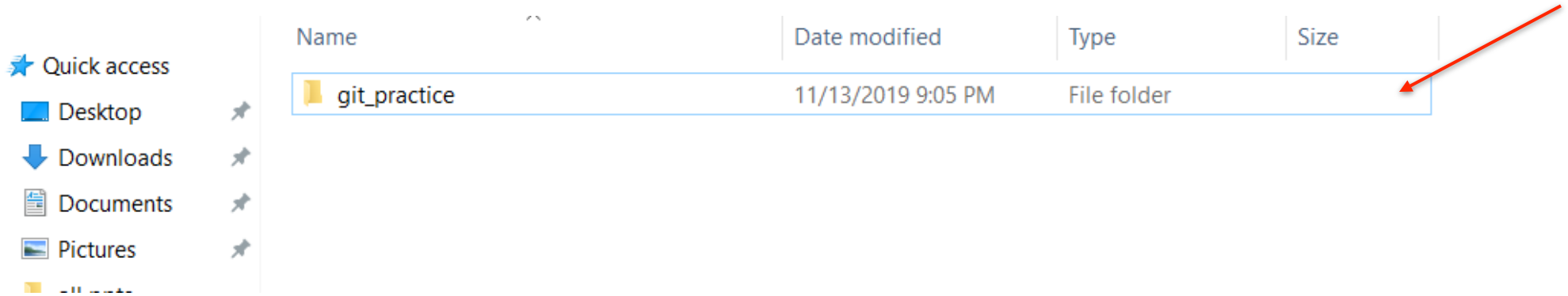


- When asked for username and password, enter your GitHub username and password
- When you see the following in Git bash, refresh GitHub webpage

```
                -92Q6OTF4 MINGW64 /d/git_practice (master)
$ git remote add origin https://github.com/ruchikaverma-iitg/git_practice.git

                92Q6OTF4 MINGW64 /d/git_practice (master)
$ git push -u origin master
Enumerating objects: 6, done.
Counting objects: 100% (6/6), done.
Delta compression using up to 12 threads
Compressing objects: 100% (3/3), done.
Writing objects: 100% (6/6), 542 bytes | 271.00 KiB/s, done.
Total 6 (delta 1), reused 0 (delta 0)
remote: Resolving deltas: 100% (1/1), done.
To https://github.com/ruchikaverma-iitg/git_practice.git
 * [new branch]      master -> master
Branch 'master' set up to track remote branch 'master' from 'origin'.
```

DELETE LOCAL

- Delete local git_practice

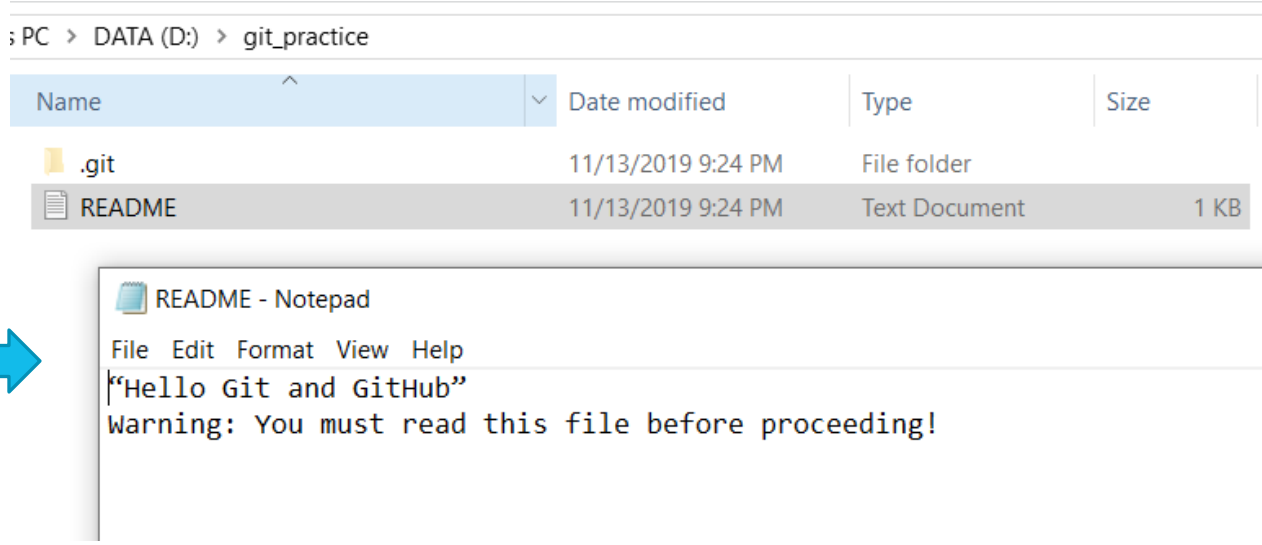


CLONING GITHUB REPOSITORY INTO LOCAL

- git clone path (Path of the remote directory)

Clone remote directory into the current directory

```
                '-92Q6OTF4 MINGW64 ~ (master)
$ cd D:

                92Q6OTF4 MINGW64 /d
$ git clone https://github.com/ruchikaverma-iitg/git_practice
Cloning into 'git_practice'...
remote: Enumerating objects: 6, done.
remote: Counting objects: 100% (6/6), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 6 (delta 1), reused 6 (delta 1), pack-reused 0
Unpacking objects: 100% (6/6), done.
```

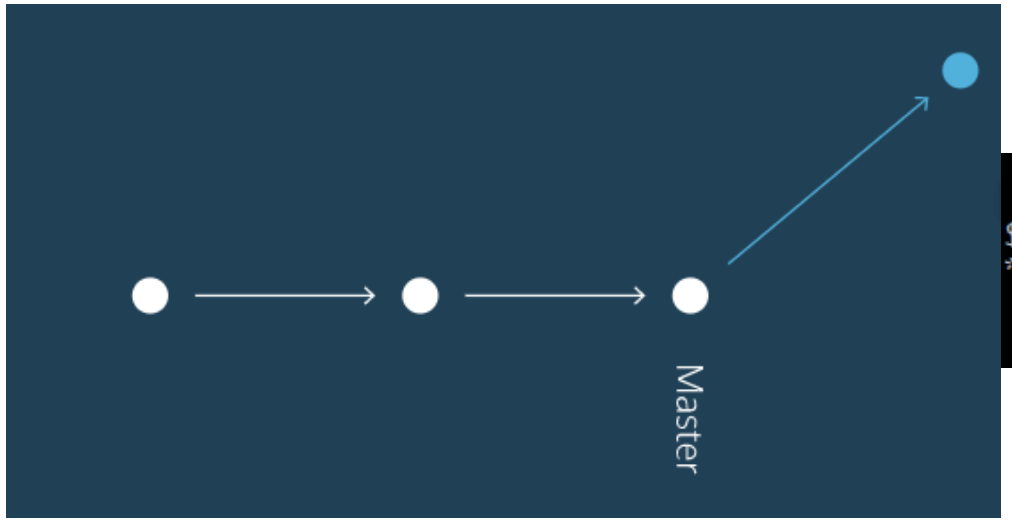


GIT BRANCHING I

- By default the branch name is called “master”

```
-92Q6OTF4 MINGW64 /d
$ cd git_practice

-92Q6OTF4 MINGW64 /d/git_practice (master)
$
```

- git branch new_branch create a new branch titled, “new_branch”




```
-92Q6OTF4 MINGW64 /d/git_practice ((f50a3d9...))
$ git branch
* (HEAD detached at refs/heads/new_branch)
  master
  new_branch
```

GIT BRANCHING II

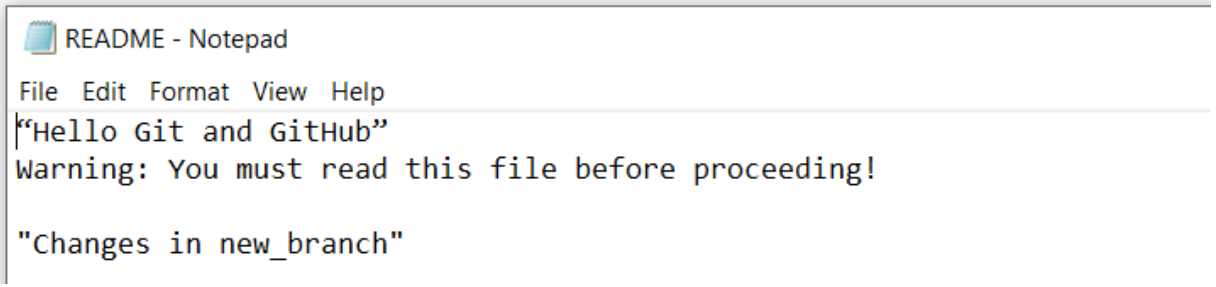
- git checkout new_branch switch to the new branch

```
                -92Q6OTF4 MINGW64 /d/git_practice (master)
$ git checkout new_branch
Switched to branch 'new_branch'
```

- git log new_branch shares the same commit history as “master”

```
                -92Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git log
commit f50a3d9868b56349eafaf12dfe546a63a2ce0f77 (HEAD -> new_branch, origin/mast
er, origin/HEAD, master)
Author: Ruchika Verma <24606766+ruchikaverma-iitg@users.noreply.github.com>
Date:   Wed Nov 13 19:09:32 2019 -0500

    Warning added to readme file.

commit 2871c232e7aea6f05c54d5bc016fb60e16c9aeff
Author: Ruchika Verma <24606766+ruchikaverma-iitg@users.noreply.github.com>
Date:   Wed Nov 13 19:05:50 2019 -0500

    First Commit
```

GIT BRANCHING III



Check status : README.txt got modified in new_branch

Add changes to the staging area

Commit changes in new_branch

```
                2Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git status
On branch new_branch
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   README.txt

no changes added to commit (use "git add" and/or "git commit -a")

                Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git add README.txt

               92Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git commit -m "Changes in new_branch"
[new_branch 8525376] Changes in new_branch
 1 file changed, 2 insertions(+)
```

GIT BRANCHING IV

Changes in new_branch are visible in its commit history

```
                -92Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git log
commit 8525376dd40a7655369127a46ac600b550addf00 (HEAD -> new_branch)
Author: Ruchika Verma <24606766+ruchikaverma-iitg@users.noreply.github.com>
Date:   Wed Nov 13 22:26:47 2019 -0500

    Changes in new_branch

commit f50a3d9868b56349eafaf12dfe546a63a2ce0f77 (origin/master, origin/HEAD, master)
Author: Ruchika Verma <24606766+ruchikaverma-iitg@users.noreply.github.com>
Date:   Wed Nov 13 19:09:32 2019 -0500

    Warning added to readme file.

commit 2871c232e7aea6f05c54d5bc016fb60e16c9aeff
Author: Ruchika Verma <24606766+ruchikaverma-iitg@users.noreply.github.com>
Date:   Wed Nov 13 19:05:50 2019 -0500

    First Commit
```

Switch to master

```
                -92Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git checkout master
Switched to branch 'master'
Your branch is up to date with 'origin/master'.

                -92Q6OTF4 MINGW64 /d/git_practice (master)
$ git log
commit f50a3d9868b56349eafaf12dfe546a63a2ce0f77 (HEAD -> master, origin/master, origin/HEAD)
Author: Ruchika Verma <24606766+ruchikaverma-iitg@users.noreply.github.com>
Date:   Wed Nov 13 19:09:32 2019 -0500

    Warning added to readme file.

commit 2871c232e7aea6f05c54d5bc016fb60e16c9aeff
Author: Ruchika Verma <24606766+ruchikaverma-iitg@users.noreply.github.com>
Date:   Wed Nov 13 19:05:50 2019 -0500

    First Commit
```

Changes in new_branch are not visible in “master” commit history

GIT MERGE

- git merge new_branch update master with the changes made in new_branch

Switch to master

Merge changes

```
                -92Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git checkout master
Switched to branch 'master'
Your branch is up to date with 'origin/master'.

                -92Q6OTF4 MINGW64 /d/git_practice (master)
$ git merge new_branch
Updating f50a3d9..8525376
Fast-forward
 README.txt | 2 ++
 1 file changed, 2 insertions(+)
```

Merge was successful because master had not changed since we made a commit on new_branch

MERGE CONFLICT I

- What would happen if we made a commit on master before merging the updated new_branch?

```
'-92Q6OTF4 MINGW64 /d/git_practice (master)
$ git checkout new_branch
Switched to branch 'new_branch'
```

```
-92Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git checkout master
Switched to branch 'master'
Your branch is ahead of 'origin/master' by 1 commit.
  (use "git push" to publish your local commits)
```

README - Notepad

File Edit Format View Help

```
“Hello Git and GitHub”
Warning: You must read this file before proceeding!

"Changes in new_branch"
"More changes in new_branch"
```

README - Notepad

File Edit Format View Help

```
“Hello Git and GitHub”
Warning: You must read this file before proceeding!

"Changes in new_branch"
"No changes required in master"
```

```
-92Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git add README.txt

-92Q6OTF4 MINGW64 /d/git_practice (new_branch)
$ git commit -m "Committing more changes in new_branch"
[new_branch 6c4f558] Committing more changes in new_branch
 1 file changed, 1 insertion(+)
```

```
-92Q6OTF4 MINGW64 /d/git_practice (master)
$ git add README.txt

-92Q6OTF4 MINGW64 /d/git_practice (master)
$ git commit -m "Changes in master"
[master 63c3eb8] Changes in master
 1 file changed, 1 insertion(+)
```

MERGE CONFLICT II

```
                -92Q6OTF4 MINGW64 /d/git_practice (master)
$ git merge new_branch
Auto-merging README.txt
CONFLICT (content): Merge conflict in README.txt
Automatic merge failed; fix conflicts and then commit the result.
```

README - Notepad

File Edit Format View Help

```
“Hello Git and GitHub”
Warning: You must read this file before proceeding!

"Changes in new_branch"
<<<<<<< HEAD
"No changes required in master"
=======
"More changes in new_branch"
>>>>>>> new_branch
```

Merge conflict

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"Changes in new_branch"
"More changes in new_branch"
```

```
                -92Q6OTF4 MINGW64 /d/git_practice (master|MERGING)
$ git add README.txt

                -92Q6OTF4 MINGW64 /d/git_practice (master|MERGING)
$ git commit -m "Final Commit"
[master be62272] Final Commit
```

DELETE BRANCH

- git branch –d branch_name (to be deleted)

GIT PUSH LOCAL TO GIT

```
            ›-92Q6OTF4 MINGW64 /d/git_practice (master)
$ git push
Enumerating objects: 14, done.
Counting objects: 100% (14/14), done.
Delta compression using up to 12 threads
Compressing objects: 100% (8/8), done.
Writing objects: 100% (12/12), 1.11 KiB | 377.00 KiB/s, done.
Total 12 (delta 4), reused 0 (delta 0)
remote: Resolving deltas: 100% (4/4), done.
To https://github.com/ruchikaverma-iitg/git_practice
   f50a3d9..be62272  master -> master
```

ruchikaverma-iitg / git_practice

Code | Issues 0 | Pull requests 0 | Actions | Projects 0

Description

GitHub short course

Manage topics

6 commits | 1 branch | 0 packages

Branch: master | New pull request

ruchikaverma-iitg Final Commit

README.txt — Final Commit

README.txt

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"More changes in new_branch"
```
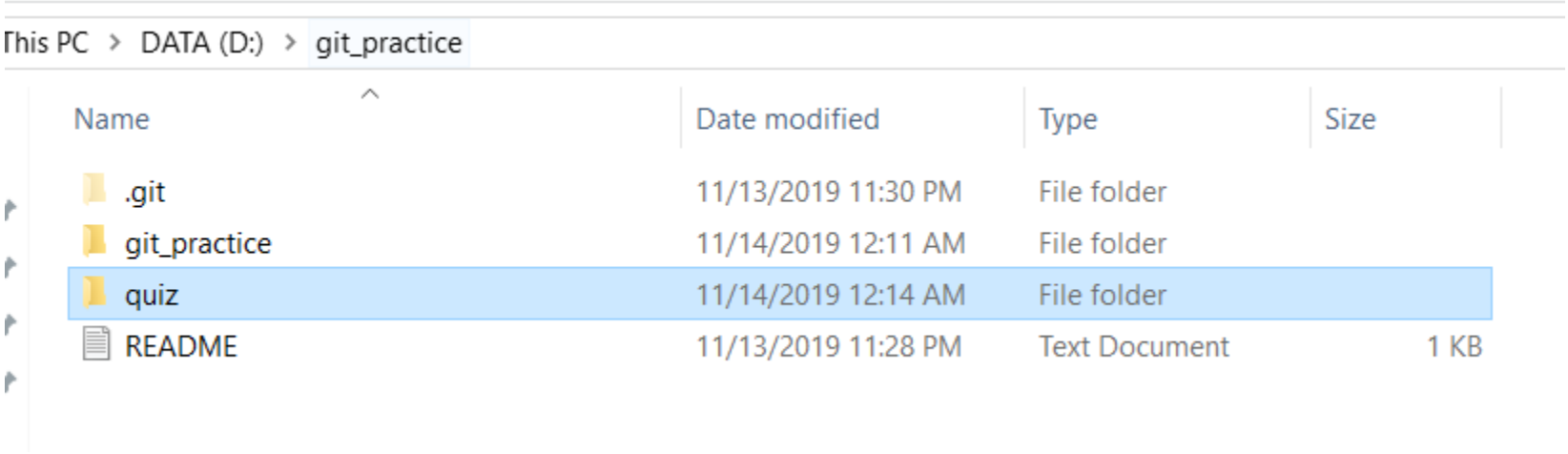

GIT CLONE

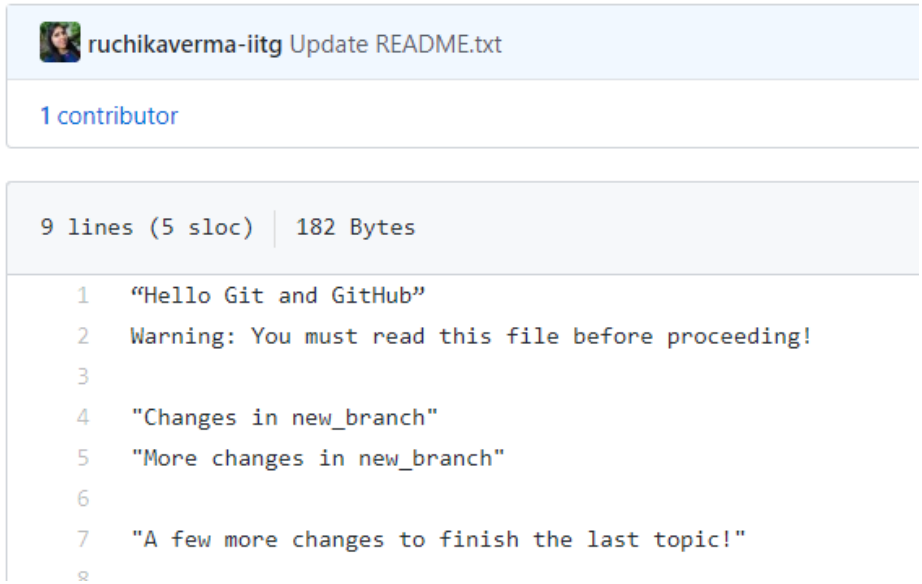
```
-92Q6OTF4 MINGW64 /d/git_practice (master)
$ git clone https://github.com/ruchikaverma-iitg/git_practice quiz
Cloning into 'quiz'...
remote: Enumerating objects: 18, done.
remote: Counting objects: 100% (18/18), done.
remote: Compressing objects: 100% (6/6), done.
remote: Total 18 (delta 6), reused 17 (delta 5), pack-reused 0
Unpacking objects: 100% (18/18), done.
```

Clone remote repository to local directory named quiz



GIT FETCH I

```
                -92Q6OTF4 MINGW64 /d/git_practice (master)
$ git remote -v
origin  https://github.com/ruchikaverma-iitg/git_practice (fetch)
origin  https://github.com/ruchikaverma-iitg/git_practice (push)
```



Remote repository from where the cloning was done called “remote” for reference

- New changes in the remote repository
- Clone (in quiz) is not up-to-date on the local machine

GIT FETCH II

```
                2Q6OTF4 MINGW64 /d/git_practice/quiz (master)
$ git fetch
remote: Enumerating objects: 5, done.
remote: Counting objects: 100% (5/5), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 3 (delta 1), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), done.
From https://github.com/ruchikaverma-iitg/git_practice
   be62272..20b00d2  master     -> origin/master
```

- Merge changes from remote into the local repository (quiz)
- Bring new changes in the origin/master (different from “master”)

- New changes are in the repository called “origin/master”

GIT MERGE ORIGIN/MASTER

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"More changes in new_branch"

"A few more changes to finish the last topic!"

```
)2Q6OTF4 MINGW64 /d/git_practice/quiz (master)
$ git merge origin/master
Updating be62272..20b00d2
Fast-forward
 README.txt | 1 +
 1 file changed, 1 insertion(+)
```

- Merge changes in the "master"
- Complete your assignment/quiz

GIT PUSH

```
                92Q6OTF4 MINGW64 /d/git_practice/quiz (master)
$ git add README.txt

                92Q6OTF4 MINGW64 /d/git_practice/quiz (master)
$ git commit -m "Finishing!"
[master ac32692] Finishing!
 1 file changed, 1 insertion(+)

                92Q6OTF4 MINGW64 /d/git_practice/quiz (master)
$ git push origin master
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 12 threads
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 320 bytes | 106.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0)
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To https://github.com/ruchikaverma-iitg/git_practice
   20b00d2..ac32692  master -> master
```

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```
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"Changes in new_branch"
"More changes in new_branch"

"A few more changes to finish the last topic!"
"Quiz completed :)"
```

ruchikaverma-iitg Finishing!

README.txt

README.txt

```
“Hello Git and GitHub”
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"Changes in new_branch"
"More changes in new_branch"

"A few more changes to finish the last topic!"
"Quiz completed :)"
```

- Add and commit new changes
- Push master to the remote (GITHUB) for evaluation

THANK YOU!