

Skill Lab – Version Control using Git

Introduction: Git and GitHub are integral tools for modern software development, providing an efficient and collaborative approach to version control. This guide aims to provide a clear and professional overview of Git, GitHub, and their practical usage.

What is Git?

Git is a free and open-source Version Control System (VCS) that facilitates tracking changes in code, maintaining a comprehensive history, and enabling seamless collaboration within development teams. It is widely adopted and considered a staple in the software development workflow.

What is GitHub?

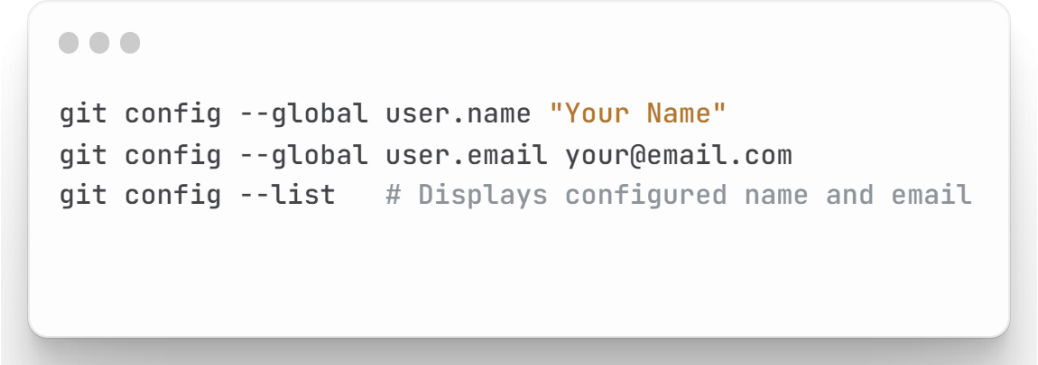
GitHub is a web-based platform for hosting Git repositories. It serves as a centralized hub for developers to store, collaborate, and manage their projects online. The README.md file, written in Markdown, is a key component within GitHub repositories, providing project details and documentation.

Using Git

1. **Command Line (Most Popular):** Git's command-line interface is the most widely used method for interacting with repositories. It offers a powerful and flexible way to manage code.
2. **IDEs and Code Editors (e.g., VS Code):** Integrated Development Environments (IDEs) and code editors, such as Visual Studio Code, offer user-friendly interfaces and seamless Git integration, making version control accessible during the development process.
3. **Graphical User Interface (e.g., GitKraken):** Git can also be utilized through graphical user interfaces like GitKraken, providing a visual representation of the version control process for those who prefer a more intuitive approach.

Configuring Git

Ensure your identity is correctly set up for Git usage by configuring your global settings:



```
git config --global user.name "Your Name"
git config --global user.email your@email.com
git config --list # Displays configured name and email
```

Basic Commands

1. Clone

Clone a repository onto your local machine using the following command

```
• git clone <repository_link>
```

2. Status

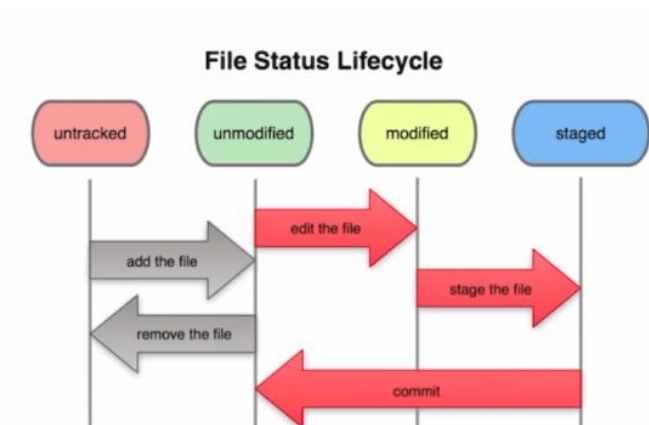
Check the state of your code with:

```
• git status
```

3. View Hidden Files

To view hidden files in Git, use:

```
ls -a
```

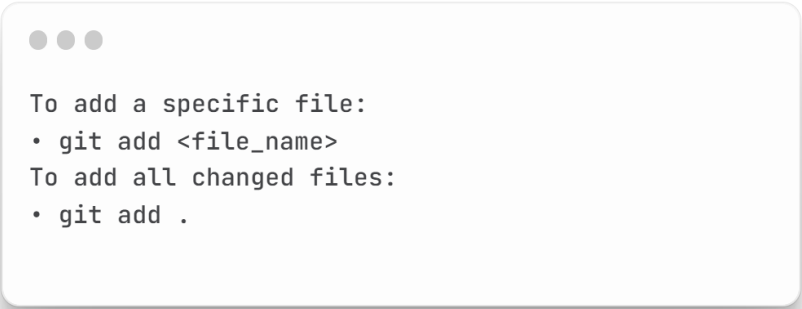


Committing Changes in Git:

After making changes to your code, it's essential to follow a structured process to incorporate those changes into your Git repository. This involves using the **add**, **commit**, and **push** commands.

1. Add

The **add** command is used to stage changes for commit. You can add specific files or all modified files in your working directory.



```
● ● ●  
To add a specific file:  
• git add <file_name>  
To add all changed files:  
• git add .
```

2. Commit

The **commit** command creates a record of the changes you've staged. It's important to include a meaningful commit message to describe the purpose of the changes.

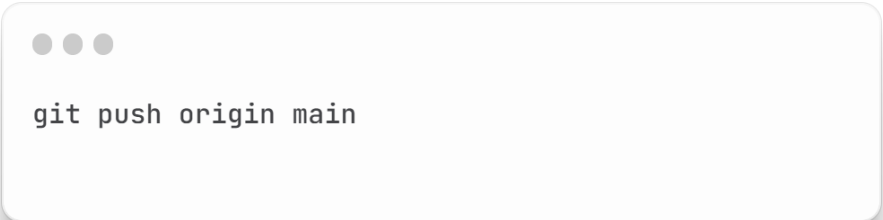


```
● ● ●  
git commit -m "Your descriptive commit message here"
```

Ensure your commit messages are clear and concise, providing context about the modifications made.

3. Push

After committing changes locally, you'll want to upload them to the remote repository. The **push** command accomplishes this by sending your local changes to the specified branch on the remote repository.



```
● ● ●  
git push origin main
```

Here, replace **main** with the branch you're working on if it's different. Ensure that your local branch is tracking the remote branch.

Initializing a New Git Repository:

The **git init** command is a fundamental step when creating a new Git repository. Below is a step-by-step guide, including commands, to help you initiate a new Git repository, add files, and interact with a remote repository on GitHub.

1. **Initialize a New Git Repository:**

Use the following command to create a new, empty Git repository in your current working directory:



```
git init
```

2. **Adding a Remote Repository (GitHub, for example):**

After creating a new repository on GitHub, use the following command to link your local repository to the remote one:

3. **Verify Remote Repository:**

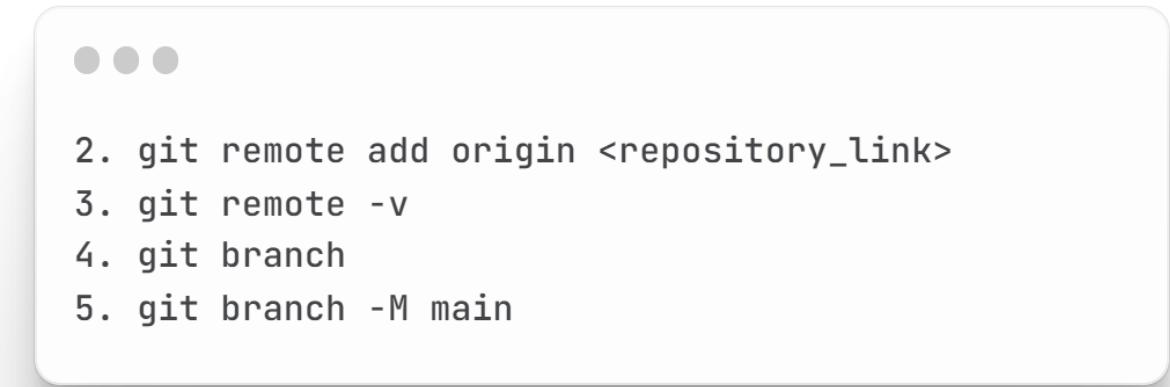
To confirm the remote repository linked, use:

4. **Checking Branches:**

To see the available branches in your repository:

5. **Rename the Default Branch (if necessary):**

If you want to rename the default branch (e.g., from "master" to "main"), use:



```
2. git remote add origin <repository_link>
3. git remote -v
4. git branch
5. git branch -M main
```

6. Pushing Changes to the Remote Repository:

After making changes and committing, use the following command to push your changes to the remote repository:



```
git push origin main
```

If it's the first push, you can use the **-u** flag to set the upstream branch. This allows you to use **git push** without specifying the remote branch and local branch names in the future:



```
• git push -u origin main
```

7. Quickly Add and Commit Changes:

If you've edited a single file and want to add and commit it in one go, you can use the **-am** flags:



```
git commit -am "Your commit message here"
```

This command stages and commits all changes, including new and modified files, with a single command.

Creating a New Directory in Your Git Repository:

When establishing a new directory within your Git repository, adhere to the following commands:

1. Create a New Directory:

Utilize the **mkdir** command to generate a new directory. For instance:

This command ensures the creation of a new folder in your existing project structure.

2. Navigate to the New Directory:

Transition into the freshly created directory by executing:



1. `mkdir <directory_name>`
2. `cd <directory_name>`

Effective Branch Management Commands in Git:

Managing branches is a crucial aspect of version control in Git. Below are key commands for branch management, along with explanations and examples:

1. **Check Available Branches:**

To view a list of existing branches in your repository:

2. **Rename a Branch:**

If you need to rename a branch, for example, from "master" to "main," use:

3. **Switch to a Different Branch:**

To navigate between branches, use the git checkout command:

4. **Create a New Branch:**

To create a new branch and switch to it in one go, use the -b option with git checkout:

5. **Delete a Branch:**

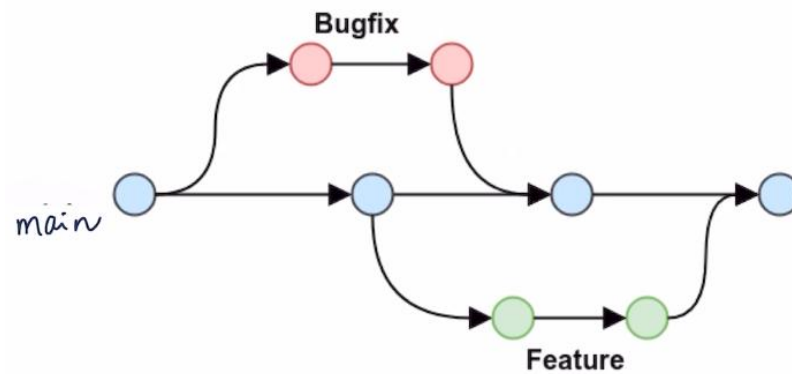
If a branch is no longer needed, use the following command to delete it:

6. **Push a Branch with Upstream:**

If you attempt to push a branch without an upstream branch, Git will provide guidance on setting it:



1. `git branch`
2. `git branch -M main`
3. `git checkout <branch_name>`
4. `git checkout -b <new_branch_name>`
This creates a new branch and switches your working directory to the newly created branch.
5. `git branch -d <branch_name>`
Note: The branch must be fully merged into the current branch before deletion.
6. `git push --set-upstream origin <branch_name>`
Replace `<branch_name>` with the name of your branch. This command establishes the upstream branch for subsequent pushes.



Efficient Code Merging and Mistake Resolution in Git:

Merging Code:

1. Compare Branches:

Utilize the **git diff** command to compare commits, branches, files, and more. To compare branches:

```
git diff <branch_name>
```

2. Merge Branches:

To merge two branches, use the **git merge** command:

```
git merge <branch_name>
```

Alternatively, create a Pull Request (PR) in GitHub to propose and merge changes.

Pull Request (PR):

1. Create a Pull Request:

Initiate changes in GitHub, creating a PR to inform others about modifications pushed to a branch:

In GitHub, click on "Compare & pull request."

Provide comments and details, allowing teammates to understand the changes.

After merging, differences between the main and feature branches can be reviewed.

2. Update Local System with Changes:

To view changes in your local system, use:



```
git pull origin main
```

This fetches and downloads content from the remote repository, updating the local repository.

Merge Conflicts:

An event that takes place when Git is unable to automatically resolve differences in code between two commits.



```
git merge <branch_name>
```

SSH - Secure Shell

SSH (Secure Shell) is a protocol used to securely log onto remote systems or transfer data over unsecured networks. In the context of Git, it acts as a secure "tunnel" that identifies you using a cryptographic key pair rather than a username and password.

Difference between SSH vs. HTTP (HTTPS)

1. Authentication Method

- **SSH:** Uses a cryptographic key pair (a public file and a private file stored on your computer).
- **HTTPS:** Uses a username and Personal Access Token (essentially a password).

2. Daily Convenience

- **SSH:** Set it and forget it. Once configured, you never have to type a password again when pushing/pulling code.
- **HTTPS:** Often requires you to enter credentials periodically, unless you set up a specific "Credential Manager" to cache them.

3. Initial Setup

- **SSH:** Harder. You must generate keys, copy specific codes, and paste them into GitHub/GitLab settings.
- **HTTPS:** Easiest. You just copy the URL (`https://...`) and run the clone command immediately.

4. Firewall & Network Issues

- **SSH:** Uses **Port 22**. Strict corporate or university Wi-Fi networks sometimes block this port (security restrictions).
- **HTTPS:** Uses **Port 443**. This is standard web traffic (same as browsing Google), so it is rarely blocked.

5. URL Format

- **SSH:** Looks like: `git@github.com:username/repo.git`
- **HTTPS:** Looks like: `https://github.com/username/repo.git`

Steps to Create & Add SSH Keys

1. Generate the Key

- Open your terminal (Git Bash on Windows).
- Run the command –

```
ssh-keygen -t ed25519 -C your_email@example.com
```

- Press Enter to accept default file location.
- Press Enter twice (skip the passphrase for now to keep it simple).
- Copy the Public Key

2. Add Key to the Platform

- **GitHub**

1. Go to **Settings** (in profile icon).
2. Select **SSH and GPG keys**
3. Click **New SSH key**
4. Title: "Suitable Title" -> Paste key -> Click **Add SSH key**.

- **GitLab**

1. Go to **Preferences** (or Edit Profile).
2. Select **SSH Keys**
3. Click **Add new key**.

4. Paste key into the "Key" box -> Click **Add key**.

- **Bitbucket**

1. Go to **Personal Settings** (gear icon).
2. Select **SSH Keys** (under Security).
3. Click **Add Key**.
4. Paste key -> Click **Add Key**.

3. Link Key with Agent

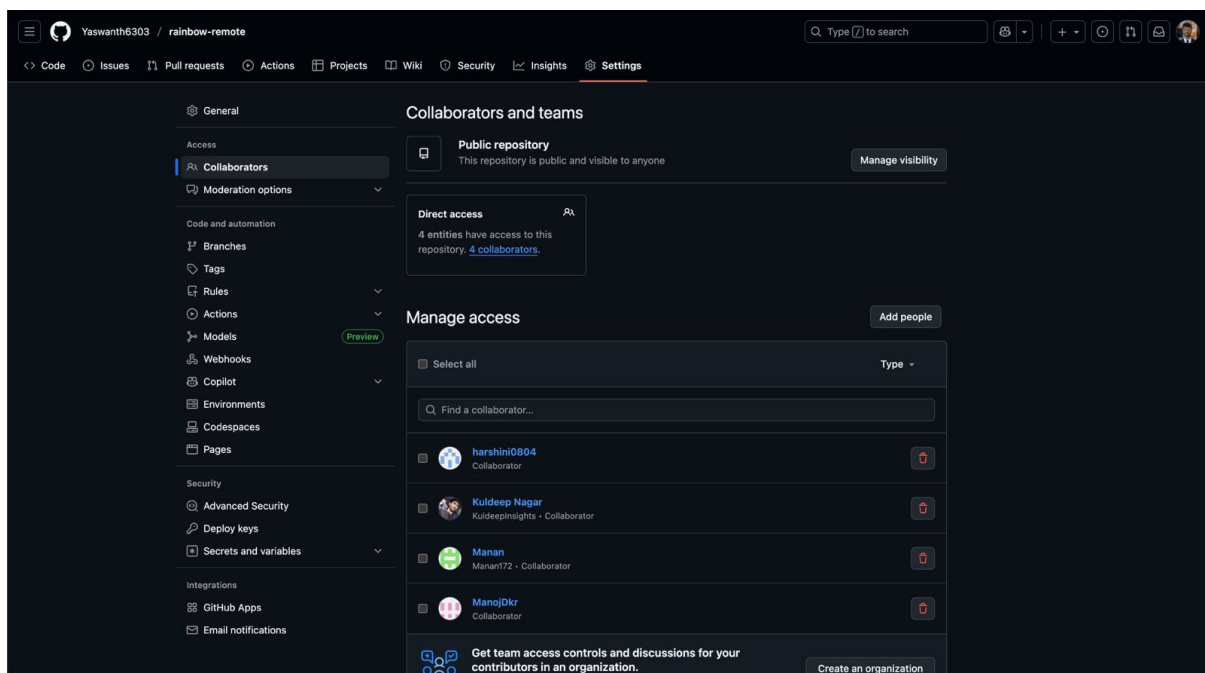
The user adds the Private Key to the Agent. This allows you to use the key without being asked for permission every time.

For Windows (Git Bash):

- Start the agent **eval "\$(ssh-agent -s)"**
- Add your private key **ssh-add ~/.ssh/id_ed25519**

Version Control & Collaboration Details

G Yaswanth



This screenshot shows the 'Pull requests' tab of the 'rainbow-remote' repository. At the top, there's a notification banner about labeling issues and pull requests for new contributors. Below this, a search bar shows 'is:pr is:closed'. The main area displays a list of pull requests, all of which are closed. The list includes:

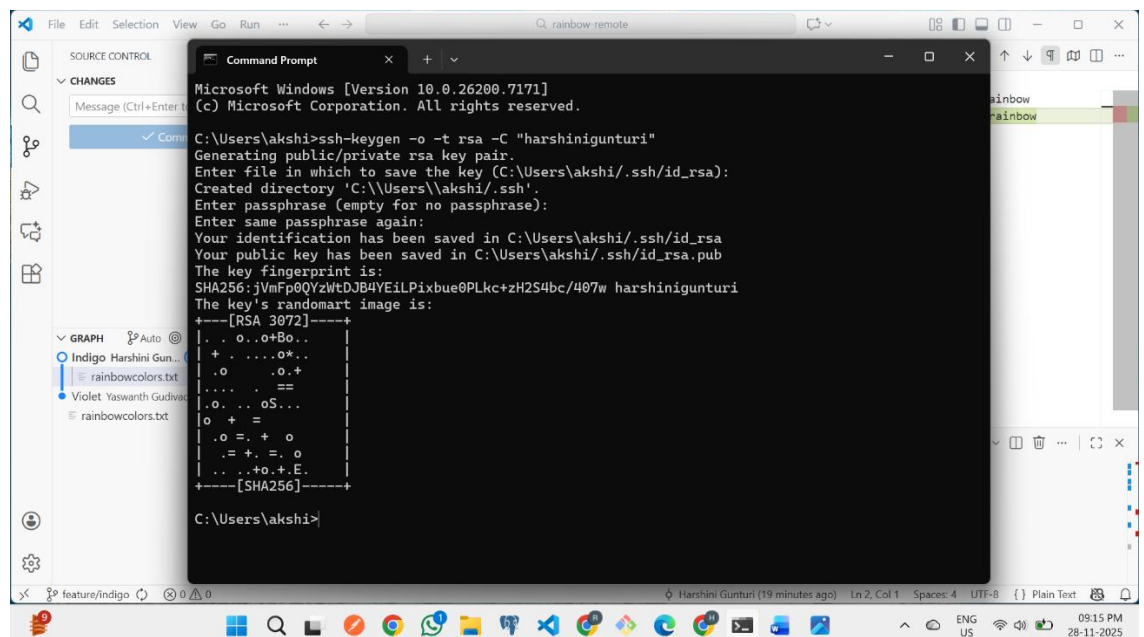
- Green**: #3 by Manan172, merged 19 minutes ago.
- Indigo**: #2 by harshini0804, merged 1 hour ago.
- Blue**: #1 by Kuldeepnights, merged 1 hour ago.

At the bottom, there's a 'ProTip!' stating that adding the 'no:label' will show everything without a label. The footer shows the GitHub logo and copyright information for 2025.

This screenshot shows the main page of the 'rainbow-remote' repository. The repository is public and has 0 stars, 0 forks, and 0 watchers. The 'main' branch is selected, showing 1 branch and 0 tags. The file 'rainbowcolors.txt' is listed with a 'Green' label, merged 23 minutes ago. The 'README' section is currently empty, with a prompt to 'Add a README' to help people understand the project. The right sidebar contains sections for 'About' (no description provided), 'Activity' (0 stars, 0 watching, 4 forks), 'Releases' (no releases published), 'Packages' (no packages published), and 'Contributors' (3 contributors: Yaswanth6303, harshini0804, and Manan172).

Screenshots of Contributors

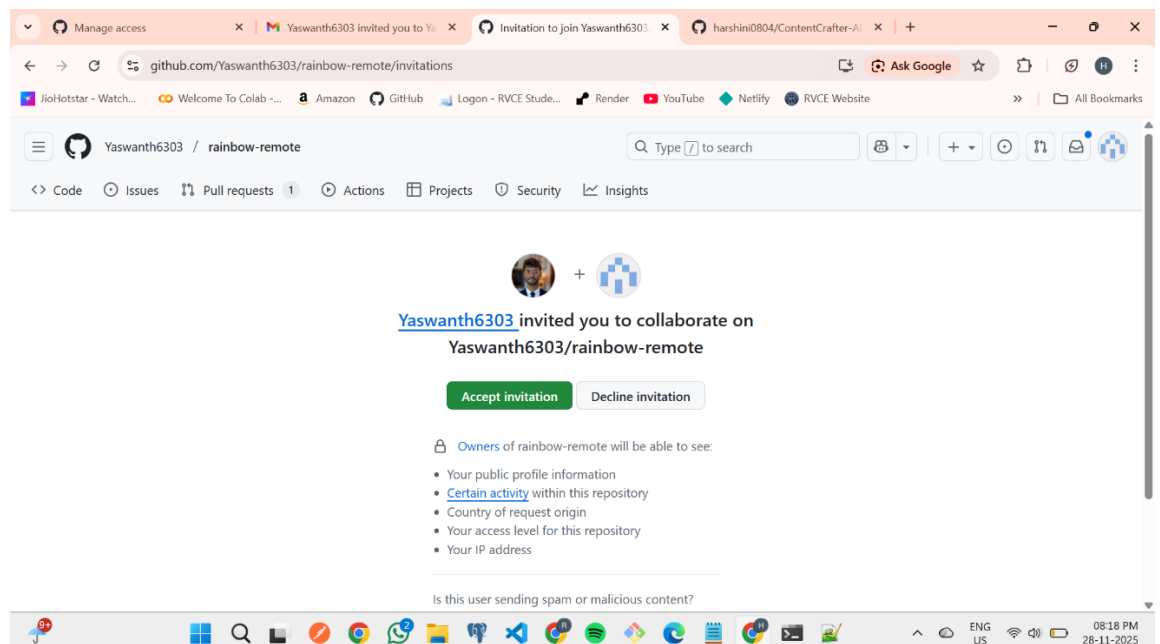
1.Gunturi Harshini

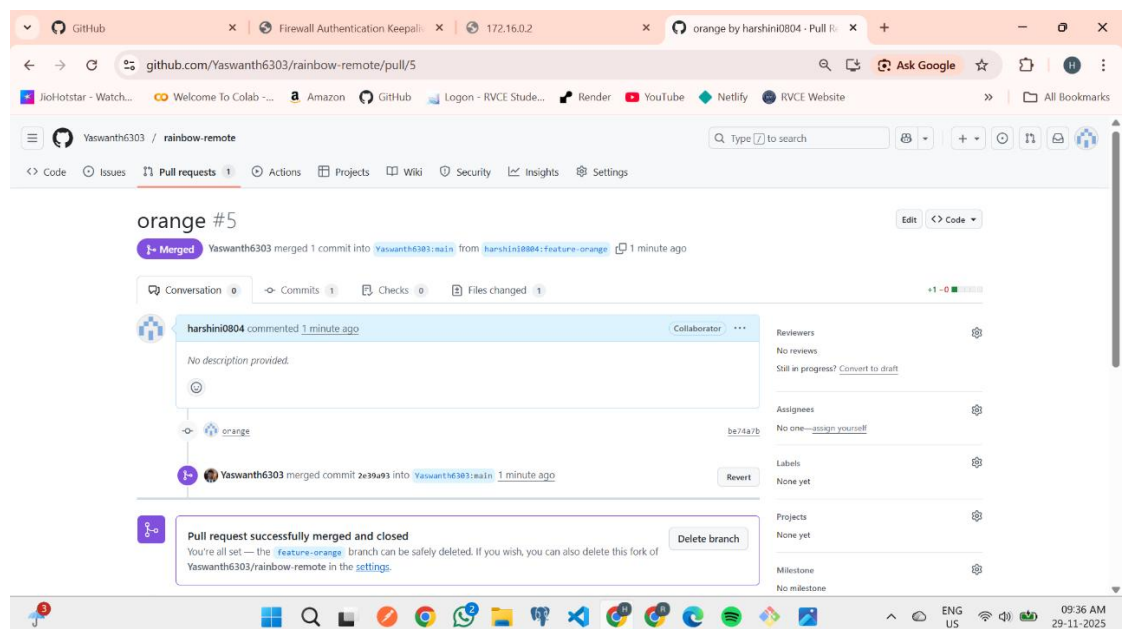
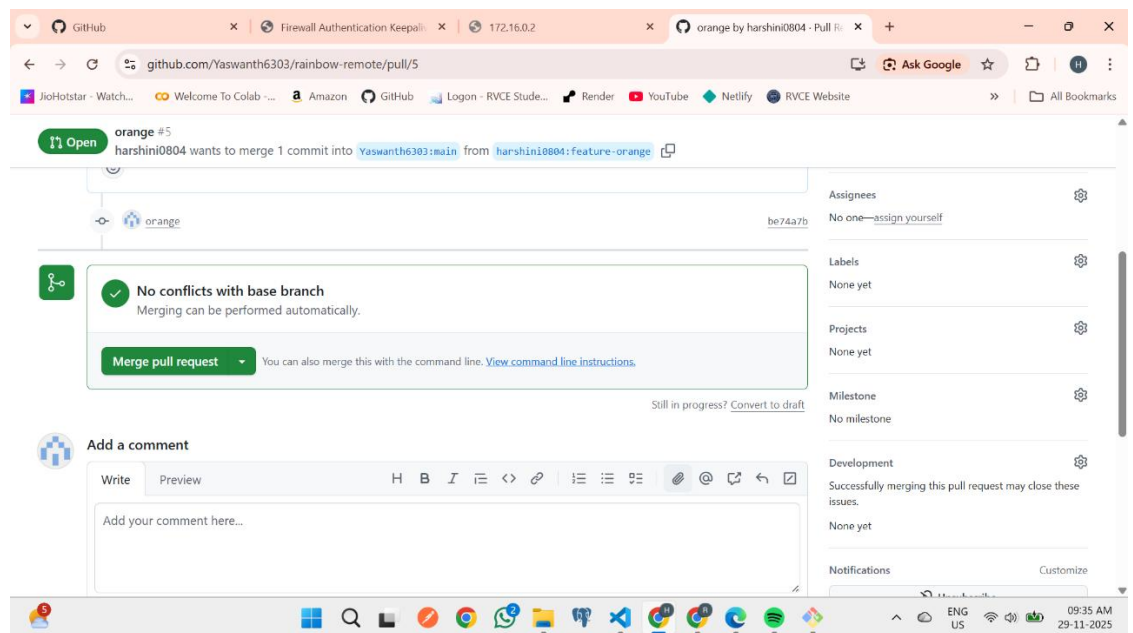


```
Microsoft Windows [Version 10.0.26200.7171]
(c) Microsoft Corporation. All rights reserved.

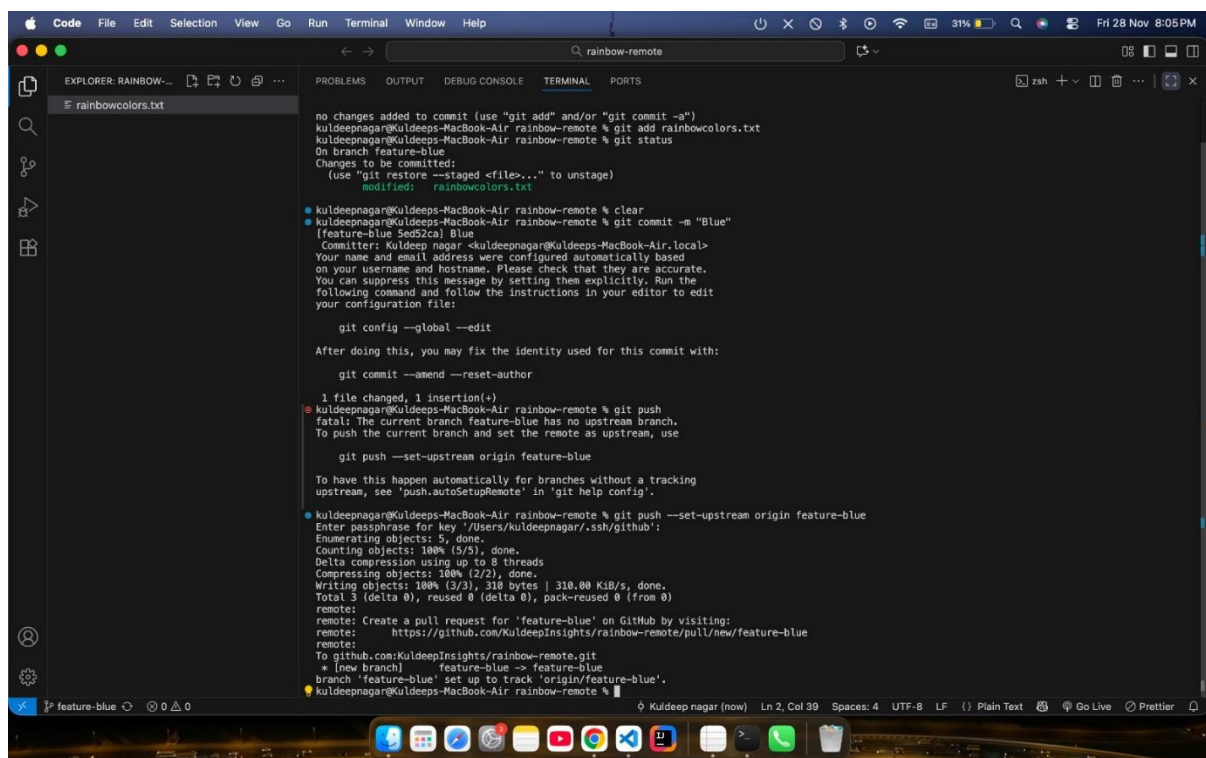
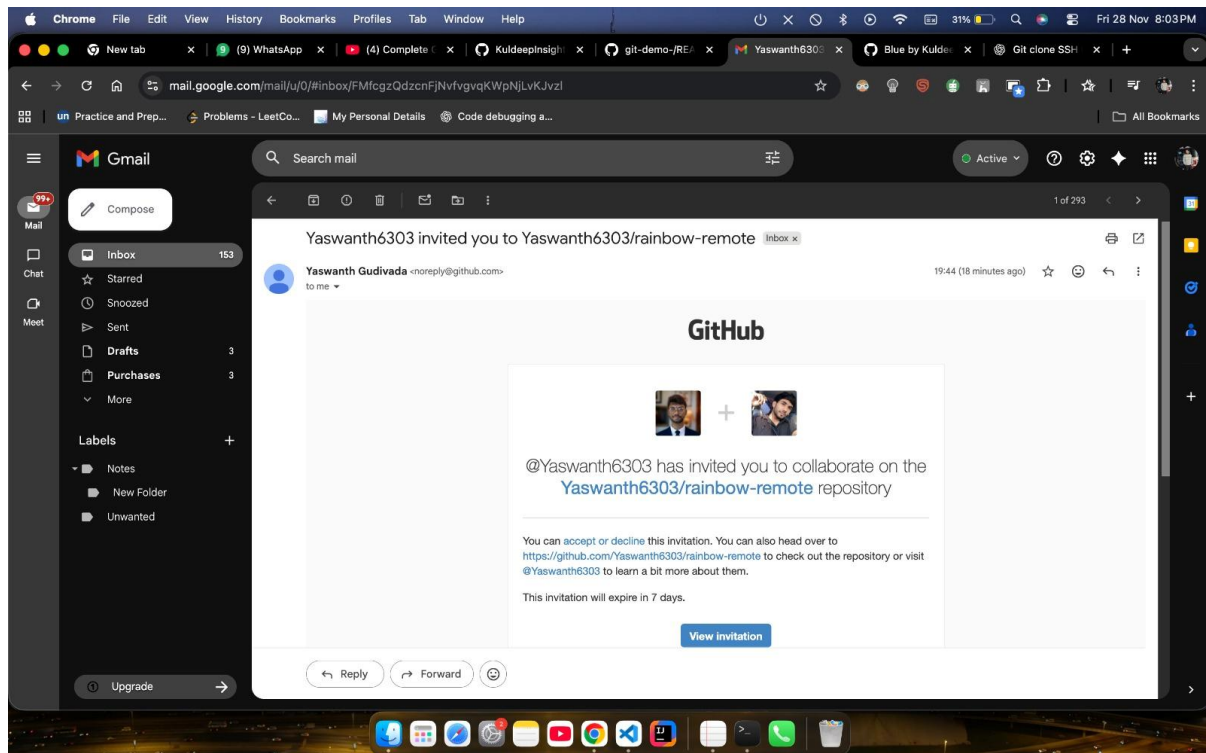
C:\Users\akshi>ssh-keygen -o -t rsa -C "harshinigunturi"
Generating public/private rsa key pair.
Enter file in which to save the key (C:\Users\akshi/.ssh/id_rsa):
Created directory 'C:\Users\akshi/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in C:\Users\akshi/.ssh/id_rsa
Your public key has been saved in C:\Users\akshi/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:jVmFp0QYzWtDJB4YEiLPixbue0PLkc+zH2S4bc/407w harshinigunturi
The key's randomart image is:
+--[RSA 3072]-----
|. . o..o+Bo..
|+ . . . .o*..
|.o . .o.+
|.... . ==
|.o..oS...
|o + =
|.o =. + o
|. = +. =. o
|. . .o.+E.
+---[SHA256]-----

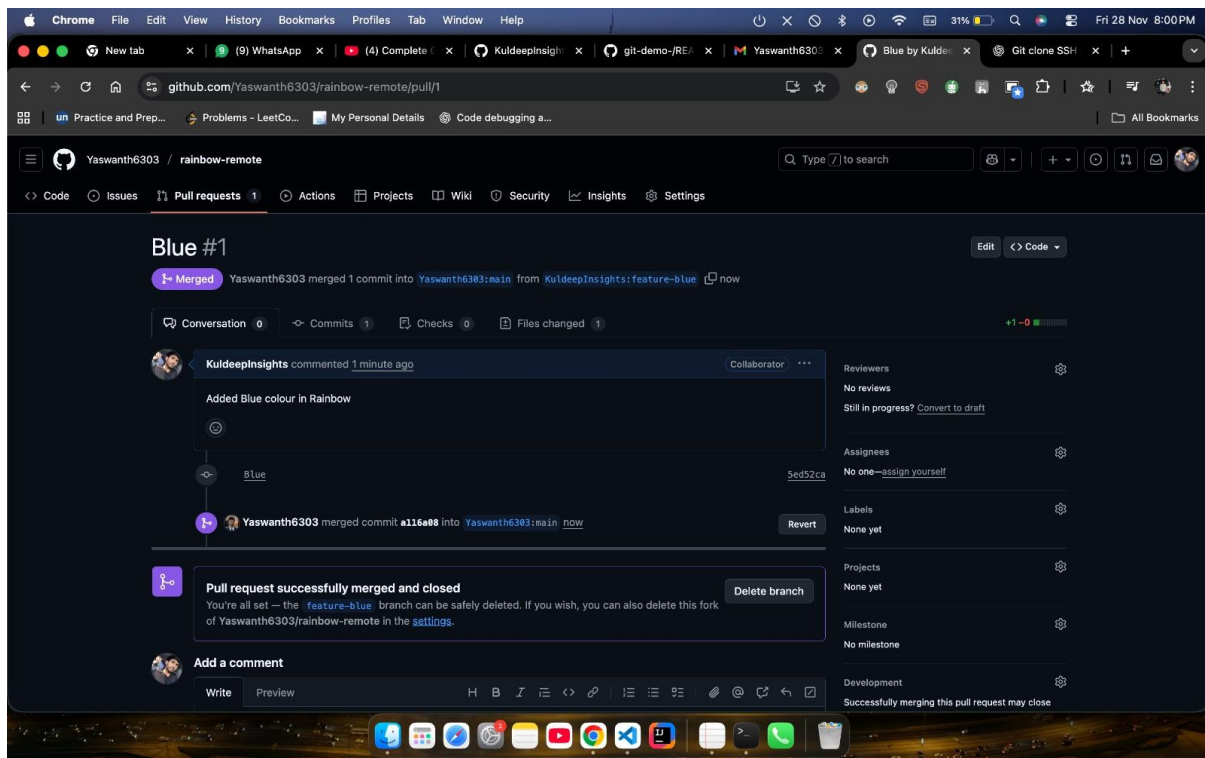
C:\Users\akshi>
```





2.Kuldeep Nagar





3. Manoj Kumar

```
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~$ eval "$(ssh-agent -s)"
Agent pid 6051
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~$ ssh-add ~/.ssh/id_ed25519
/home/manoj-kumar/.ssh/id_ed25519: No such file or directory
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~$ ssh-add ~/.ssh/id_ed25519
/home/manoj-kumar/.ssh/id_ed25519: No such file or directory
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~$ ssh-keygen -t ed25519 -C "manojkumard.mca25@rvce.edu.in"
Generating public/private ed25519 key pair.
Enter file in which to save the key (/home/manoj-kumar/.ssh/id_ed25519):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/manoj-kumar/.ssh/id_ed25519
Your public key has been saved in /home/manoj-kumar/.ssh/id_ed25519.pub
The key fingerprint is:
SHA256:4cWnr4175Lh1eD20dHGLD7FB5t6E847Xdg9A+0MQrpQ manojkumard.mca25@rvce.edu.in
The key's randomart image is:
+--[ED25519 256]--+
|      .+..+      |
|      .o.+..+    |
|      .E+oB..+   |
|      .*00.+B    |
|      o$+.oo o + |
|      o =.+ + o. |
|      * ... = *  |
|      .+. =o    |
|      +o        |
|-----[SHA256]-----
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~$
```

```
Nov 29 09:06
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git branch feature-yellow
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git branch
feature-yellow
* main
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git switch feature-yellow
M rainbowcolors.txt
Switched to branch 'feature-yellow'
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git branch
* feature-yellow
main
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git status
On branch feature-yellow
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:   rainbowcolors.txt

no changes added to commit (use "git add" and/or "git commit -a")
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git add rainbowcolors.txt
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git status
On branch feature-yellow
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
    modified:   rainbowcolors.txt

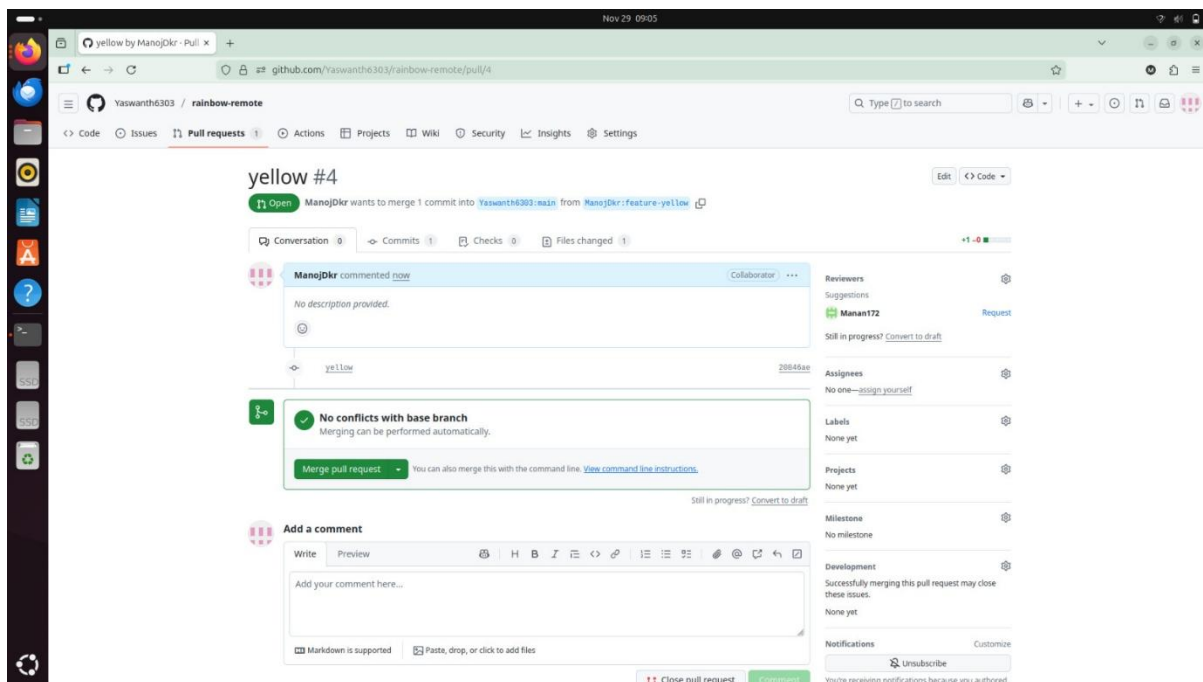
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git commit -m "yellow"
[feature-yellow 20846ae] yellow
1 file changed, 1 insertion(+)
manoj-kumar@manoj-kumar-Nitro-ANS15-57:~/Desktop/rainbow-remote$ git status
On branch feature-yellow
nothing to commit, working tree clean
```



```
manoj-kumar@manoj-kumar-Nitro-AN515-57:~/Desktop/rainbow-remote$ git commit -m "yellow"
[feature-yellow 20846ae] yellow
1 file changed, 1 insertion(+)
manoj-kumar@manoj-kumar-Nitro-AN515-57:~/Desktop/rainbow-remote$ git status
On branch feature-yellow
nothing to commit, working tree clean
manoj-kumar@manoj-kumar-Nitro-AN515-57:~/Desktop/rainbow-remote$ git push
fatal: The current branch feature-yellow has no upstream branch.
To push the current branch and set the remote as upstream, use

    git push --set-upstream origin feature-yellow

To have this happen automatically for branches without a tracking
upstream, see 'push.autoSetupRemote' in 'git help config'.
manoj-kumar@manoj-kumar-Nitro-AN515-57:~/Desktop/rainbow-remote$ ^C
manoj-kumar@manoj-kumar-Nitro-AN515-57:~/Desktop/rainbow-remote$ git push --set-upstream origin feature-yellow
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), 317 bytes | 317.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
remote:
remote: Create a pull request for 'feature-yellow' on GitHub by visiting:
remote:   https://github.com/ManojDkr/rainbow-remote/pull/new/feature-yellow
remote:
To github.com:ManojDkr/rainbow-remote.git
 * [new branch]      feature-yellow -> feature-yellow
branch 'feature-yellow' set up to track 'origin/feature-yellow'.
manoj-kumar@manoj-kumar-Nitro-AN515-57:~/Desktop/rainbow-remote$
```



4. Manan Viradiya

```

arjun-krishna@arjun-krishna-Lenovo-LQ:~$ cd ssh
arjun-krishna@arjun-krishna-Lenovo-LQ:~/ssh$ cd
arjun-krishna@arjun-krishna-Lenovo-LQ:~$ ssh-keygen -t ed25519 -C "mananvarjun-krishna@arjun-krishna-Lenovo-LQ" -f ~/.ssh/github
Generating public/private ed25519 key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/arjun-krishna/.ssh/github
Your public key has been saved in /home/arjun-krishna/.ssh/github.pub
The key fingerprint is:
SHA256:vsUXDQq/q5TCzcddgEjPUx8FNs04oR8osIV7CpJl0M mananviradiya172@gmail.com
The key's randomart image is:
+--[ED25519 256]--+
|      . . . . .      |
|      o o . . .      |
|      o o . . .      |
|      E . . . .      |
|      . . . . .      |
|      . . . . .      |
|      . . . . .      |
|      . . . . .      |
|      . . . . .      |
|      . . . . .      |
+--[SHA256]-----+
arjun-krishna@arjun-krishna-Lenovo-LQ:~$ eval "$(ssh-agent -s)"
Agent pid 10722
arjun-krishna@arjun-krishna-Lenovo-LQ:~$ ssh-add ~/.ssh/github
Identity added: /home/arjun-krishna/.ssh/github (mananviradiya172@gmail.com)
arjun-krishna@arjun-krishna-Lenovo-LQ:~$ cd
arjun-krishna@arjun-krishna-Lenovo-LQ:~$ cd .ssh
arjun-krishna@arjun-krishna-Lenovo-LQ:~/ssh$ touch config
arjun-krishna@arjun-krishna-Lenovo-LQ:~/ssh$ nano config
arjun-krishna@arjun-krishna-Lenovo-LQ:~/ssh$ ls
authorized_keys  config  github  github.pub
arjun-krishna@arjun-krishna-Lenovo-LQ:~/ssh$ cat github.pub
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIG8app95dkj0H8TG+b2FG450ltv1NcXfJ404YNDMUr2U mananviradiya172@gmail.com
arjun-krishna@arjun-krishna-Lenovo-LQ:~/ssh$ ^C
arjun-krishna@arjun-krishna-Lenovo-LQ:~/ssh$ cd
arjun-krishna@arjun-krishna-Lenovo-LQ:~$ _

```

```

arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop$ cd Desktop
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop$ git clone git@github.com:Manan172/rainbow-remote.git
Cloning into 'rainbow-remote'...
The authenticity of host 'github.com (20.207.73.82)' can't be established.
ED25519 key fingerprint is SHA256:+DLY3wvV6tUJHbpZlsF/zLDA8zPM5VHdkr4UvCQqU.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'github.com' (ed25519) to the list of known hosts.
remote: Enumerating objects: 14, done.
remote: Counting objects: 100% (14/14), done.
remote: Compressing objects: 100% (9/9), done.
remote: Total 14 (delta 2), reused 10 (delta 0), pack-reused 0 (from 0)
Receiving objects: 100% (14/14), done.
Resolving deltas: 100% (2/2), done.
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop$ cd rainbow-remote/
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ nano rainbowcolors.txt
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ nano rainbowcolors.txt
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ git branch
* main
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ git branch feature-green
fatal: 'feature-green' is not a valid branch name
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ git branch feature-green
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ git switch feature-green
M
rainbowcolors.txt
Switched to branch 'feature-green'
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ git status
On branch feature-green
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:   rainbowcolors.txt
no changes added to commit (use "git add" and/or "git commit -a")
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ git add rainbowcolors.txt
arjun-krishna@arjun-krishna-Lenovo-LQ:~/Desktop/rainbow-remote$ git commit -m "Green"
Author identity unknown

*** Please tell me who you are.

Run

git config --global user.email "you@example.com"
git config --global user.name "Your Name"

```

