

Announcements

- Teams formed
- Mentors assigned
- Quiz 1 in class today for accuracy –based on lecture
- Sign up for Google Cloud Credits ASAP. Details in an Ed post.
- Office Hours have begun. Schedule on Canvas – in CCB 267
- GPT 4o APIs out for each group tomorrow.

CS3300 A: Introduction to Software Engineering

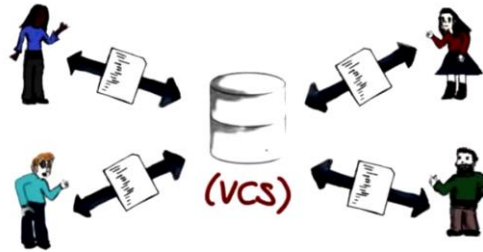
Lecture 03: Tools of the Trade #1

Version Control Systems, GIT, Code Review, GitHub
Actions

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Git Refresher

What are Version Control Systems?



- A tool that software developers use for keeping track of revisions of their project
 - snapshots of your project over time.
 - Documents, source files etc.
- Most obvious benefits:
 - Option to go back and revisit
 - Collaborate with multiple people

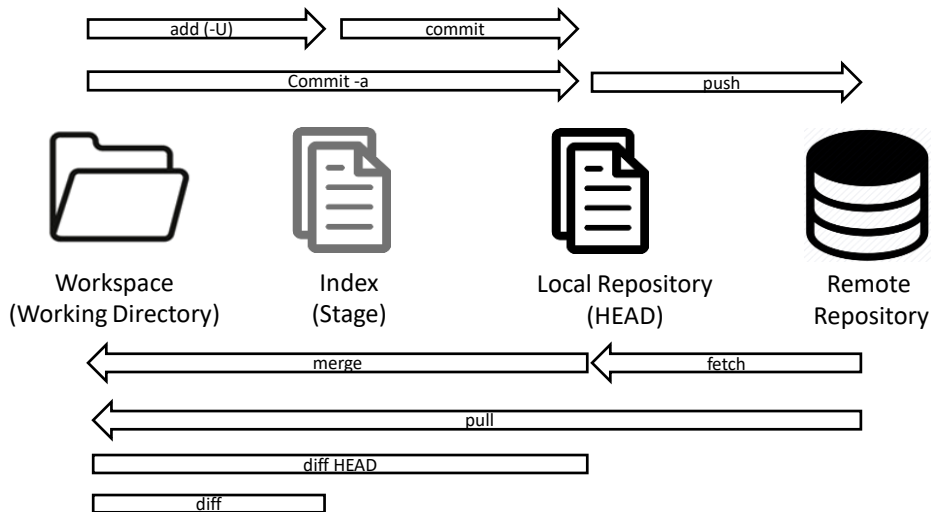
Importance

- **Enforce Discipline:** Manages process by which control of items passes from one person to another
- **Archive versions:** store subsequent versions of source-controlled items
- **Maintain Historical Information:** Author of a specific version; date and time of a specific version; etc. Retrieve and compare.
- **Enables Collaboration:** share data, files and documents
- **Recover from accidental edits/revisions**
- **Conserve Disk Space:** centralizing the management of the version.
 - Instead of having many copies spread around, one or a few central points where these copies are stored
 - efficient algorithms to store changes, so keep many versions without taking up too much space.

Don'ts in VCS

- Adding Derived Files
 - E.g., executable file derived from compiling a set of source codes
 - No reason to add it
- Adding bulky binary files
 - Try to keep them local
- Creating a local copy of files/tree of files
 - Don't do this!!
 - Useless, risky, confusing
 - Trust the version control system

GIT Workflow Recap



-U: also consider deleted files. Commit -a wont work if it is a new file. Why fetch and then merge? Compare files

GIT Plugins

Install GIT: Follow instructions on <https://git-scm.com/book/en/v2/Getting-Started-Installing-Git>

Egit: GIT Plugin available for Eclipse; can be downloaded at www.eclipse.github.com and can be installed in Eclipse



GitToolBox for IntelliJ: The plugin can be downloaded [here](#).



Visual Studio Code has integrated source control management (SCM) and includes [Git](#) support out-of-the-box.



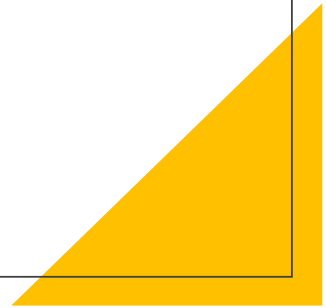
GitHub

- GIT hosting website. Get an account and create your remote repositories
- GitHub repository for your projects
- Provides easy-to-use FREE desktop clients for Mac and Windows (<https://desktop.github.com>)
- **GitHub Pages:**
 - One click to enable for your GitHub repo.
 - Hosted directly from your GitHub repository.
 - Just edit, push, and your changes are live.
 - This course's website is a GitHub Page.
- ALWAYS SET YOUR GITHUB REPOSITORY TO BE PRIVATE, UNLESS YOU ARE ABSOLUTELY SURE YOU WANT IT PUBLIC !!!

Git Basics Demo

notes on website

Branches, Merge Conflict, Code Review



GIT Demo – Creating Branches

- By default, when you create your project you will be on main/master
- It is good practice to have different branches for different features, people, etc.
- To see all local branches: `git branch`
- To create a new branch: `git branch [BRANCHNAME]`
- To move to (checkout) a branch: `git checkout [BRANCHNAME]`
- To create a new branch and move to it: `git checkout -b [BRANCHNAME]`

GIT Demo – Merging Branches

- Merging allows you to carry the changes in one branch over to another branch, combining both branches

To merge two branches:

1. `git checkout [NAME_OF_BRANCH_TO_MERGE_INTO]`
2. `git merge [NAME_OF_BRANCH_TO_BRING_IN]`

Example: merging *feature* branch into *master* branch:

1. `git checkout master`
2. `git merge feature`

Why Code Reviews?

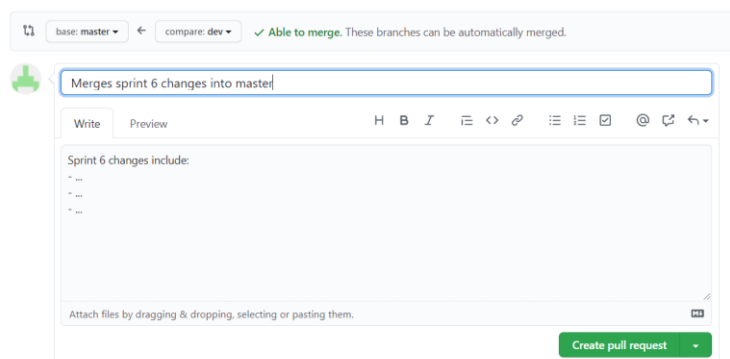
- Improve Overall Quality of Code
 - Having eyes on source code that you didn't write can help identify issues
- Facilitating Team Collaboration
 - Checking out each other's code better helps you understand how each feature is implemented
- Identifying bugs early in process
- Good for onboarding new developers to establish best practices within the organization
- Significant % of your time in your job is code maintenance.

Pull Requests

- Tool to aggregate branch changes and request that the changes be merged into a different branch.
- Done through the GitHub GUI

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](#).



The screenshot shows the GitHub interface for creating a pull request. At the top, it says "Open a pull request" and "Create a new pull request by comparing changes across two branches. If you need to, you can also [compare across forks](#)." Below this, there are two dropdown menus: "base: master" and "compare: dev", with a green checkmark and the text "Able to merge. These branches can be automatically merged." A green thumbs-up icon is visible to the left of the title input field. The title input field contains the text "Merges sprint 6 changes into master". Below the title field, there are tabs for "Write" and "Preview". The "Write" tab is active, and the text area contains "Sprint 6 changes include:" followed by three lines of placeholder text: "- -", "- -", and "- -". Below the text area, there is a note: "Attach files by dragging & dropping, selecting or pasting them." At the bottom right, there is a green button labeled "Create pull request" with a dropdown arrow.

Branch Protection

Protected branches ensure that collaborators on your repository cannot make irrevocable changes to branches. Enabling protected branches also allows you to enable other optional checks and requirements, like required status checks and required reviews.

Always have a branch protection rule enforced in your main GitHub repository branch. Settings → Branches → Branch Protection Rule → Require a pull request before merging

Note: This is only possible for public repositories (with GitHub free) and private repositories (with GitHub Pro). **So, sign up for GitHub Pro** (https://education.github.com/discount_requests/application)

Code Review Assignment: Creating Branches, Pull Requests, Performing Reviews

Both for Projects 1 and 2:

1. [Create Separate Branches for every feature](#)
 - a. You might create sub branches of these branches as you implement new portions of each feature
2. [Perform a Pull Request](#)
3. [Reviewing Code and Closing Pull Requests](#)
4. Merging Branches [**Do not delete them until the assignment is graded**]

Let's do a quick demo of these items.

GitHub Actions

A yellow right-angled triangle is positioned in the bottom right corner of the inner frame, pointing towards the top left.

GitHub Actions

- GitHub Actions is an event-driven workflow automation product for supporting the software development process in the GitHub environment.
- Using GitHub Action , we can:
 - Automate SDLC (Software Development Lifecycle) workflows
 - Implement CI/CD, DevOps



The main benefit is reducing manual work and increasing consistency and reliability in the development process.

Continuous Integration: Automatically testing and merging code changes to ensure that the codebase is always working.

Continuous Deployment: Automatically deploying code changes to production or staging environments to streamline and speed up deployment processes.

DevOps Integration: Integrate with DevOps practices by automating both operational and development tasks, creating a more cohesive workflow between developers and IT operations teams.

Anatomy of a GitHub Action

```
name: Example workflow  
on: push  
jobs:  
  build:  
    runs-on:  
      steps:  
        - uses: actions/checkout@v2  
        ...
```

Workflow



Job



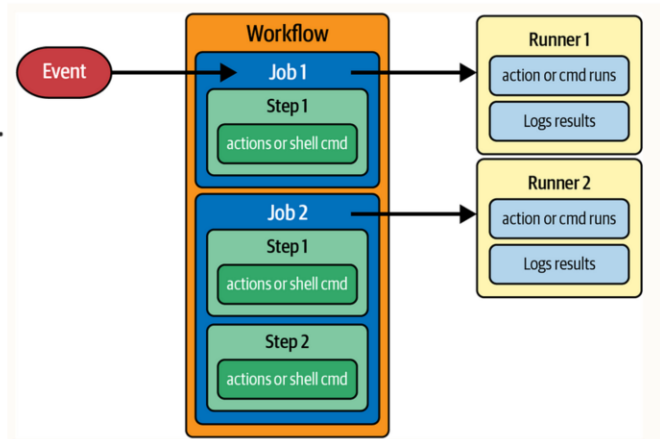
Step



Action

Anatomy of a GitHub Action

- A workflow is a unit of automation from start to finish. It contains one or more jobs.
- A workflow is triggered by an event.
- Jobs, in turn are made up of steps.
- A step either runs a shell command or invokes a predefined github action. All of the steps in a job are executed on a *runner*.
- The runner is a server(virtual or physical) or a container that has been setup to understand how to interact with GitHub Actions.



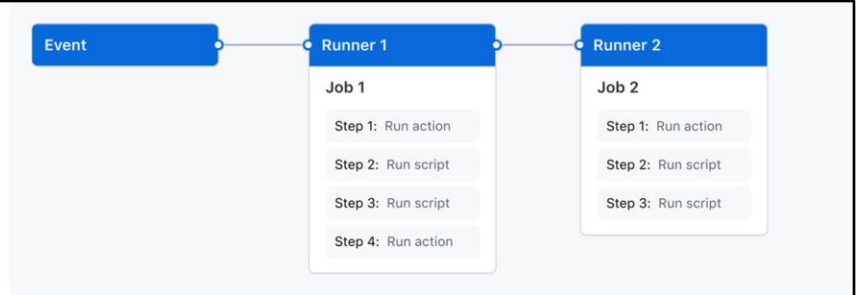
Anatomy of a GitHub Action

A **workflow** is a unit of automation from its start to finish, including the definition of what triggers the automation (**event**), what environment or other aspects should be taken into account during the automation, and what should happen due to the trigger. Examples of events include forking a repository, pushing code to a remote branch, or opening a pull request.

A **job** is a section of the workflow and is made up of one or more steps that execute on the same runner/server (ubuntu-latest is the fastest, and cheapest, job runner available.)

A **step** represents one effect of the automation. Each step consists of either a shell script that's executed, or a reference to an action that's run. When we talk about an **action** (with a lowercase "a") in this context, we mean a reusable unit of code provided to GitHub, actions published by the community, or custom actions defined for specific workflows.

Anatomy of a GitHub Action



- Your workflow contains one or more jobs which can run in sequential order or in parallel.
- Each job will run inside its own runner and has one or more steps that either run a script that you define or run an action, which is a reusable extension that can simplify your workflow.
- Steps are executed in order and are dependent on each other. Since each step is executed on the same runner, you can share data from one step to another. For example, you can have a step that builds your application followed by a step that tests the application that was built.
- An action performs a complex but frequently repeated task. An action can pull your Git repository from GitHub, set up the correct toolchain for your build environment, or set up the authentication to your cloud provider.

Events

- Single event: `on: push`
- The workflow can respond to a list (multiple events): `on: [push, pull_request]`
- The workflow can respond to event types with qualifiers, such as branches, tags, or file paths:

```
on:  
push:  
  branches:  
  - main  
  - 'rel/v*'  
tags:  
  - v1.*  
  - beta  
paths:  
  - '**.ts'
```

- The workflow can execute on a specific schedule or interval ():
- `on:using standard cron syntax scheduled:`
`- cron: '30 5,15 * * *'`
- The workflow can respond to specific manual events: `on: [workflow-dispatch, repository-dispatch]`
- The workflow can be called from other workflows: `on: workflow_call`
- The workflow can respond to common activities on GitHub items, such as adding a comment to a GitHub issue: `on: issue_comment`

•**Branches and Tags:** Workflows can be configured to run only on pushes to specific branches or tags, enhancing control over where and how the automation applies. For instance, triggering only on main or release branches.

•The pattern `v1.*` means that the workflow will be triggered for any tags that start with `v1.` followed by any other characters. For example, this could match tags like `v1.1`, `v1.2`, `v1.2.3`, etc. This is commonly used to ensure that the workflow runs for all versions within a major version series, allowing for automated processes like deployments or notifications specific to a version line.

•**Paths:** Runs the workflow only when files in specific paths are modified. In this example, any TypeScript files (`**.*.ts`).

Cron Syntax: Uses cron format to schedule workflows at specific times, for example, at 30 minutes past 5 AM and 3 PM every day. Useful for nightly builds or regular maintenance tasks.

Steps

- Three basic steps in this workflow.
- These steps
 - check out a set of code,
 - set up a go environment based on a particular version, and
 - run the go process on a source file.
- In the YAML syntax, the **- character** indicates where a step starts.
 - The **uses** clause indicates that this step invokes a predefined action.
 - The **with** clause is used to specify arguments/parameters to pass to the action.
 - And the **run** clause indicates a command to be run in the shell.
- Runners are the physical or virtual computers or containers where the code for a workflow is executed. They can be systems provided and hosted by GitHub or they can be instances you set up, host, and control. In a workflow file, runners are defined for jobs simply via the **runs-on** clause.

```
steps:  
- uses: actions/checkout@v3  
- name: setup Go version  
  uses: actions/setup-go@v2  
  with:  
    go-version: '1.14.0'  
- run: go run helloworld.go
```

```
runs-on: ubuntu-latest
```


Demo



CREATE A
NEW
REPOSITORY



SETUP A
WORKFLOW
(.GITHUB/WO
RKFLOWS)



ADD A .YML
FILE TO THE
WORKFLOW.
ADD
CONTENT



TRIGGER THE
EVENT



CHECK THE
PROGRESS OF
THE
WORKFLOW
AND JOB
USING LOGS

YAML file content

Contents from YAML file copied from:

<https://gist.github.com/weibeld/f136048d0a82aacc063f42e684e3c494>

01-hello-world.yml

```
1  name: hello-world
2  on: push
3  jobs:
4    my-job:
5      runs-on: ubuntu-latest
6      steps:
7        - name: my-step
8          run: echo "Hello World!"
```

- **name:** gives your workflow a name. This name will appear in the Actions tab of your repository.
- **on: push:** indicates that your workflow will execute whenever someone pushes to the repository. This is the event
- **my-job:** 1 job triggers on pushing
- **steps:** runs "echo Hello World" on ubuntu terminal that prints it.

Can use Yaml format beautifier

YAML file : another example

```
name: Post welcome comment
on:
  pull_request:
    types: [opened]
permissions:
  pull-requests: write
jobs:
  build:
    name: Post welcome comment
    runs-on: ubuntu-latest
    steps:
      - run: gh pr comment $PR_URL --body "Welcome to the repository!"
        env:
          GITHUB_TOKEN: ${ secrets.GITHUB_TOKEN }
          PR_URL: ${ github.event.pull_request.html_url }
```

- **permissions** assigns the workflow permissions to operate on the repository
- **pull-requests: write** gives the workflow permission to write to pull requests. This is needed to create the welcome comment.
- **run: gh pr comment \$PR_URL --body "Welcome to the repository!"**
 - This command uses the gh CLI to post a comment on a pull request.
 - gh pr comment is the command used to add a comment to a pull request.
 - \$PR_URL is a variable that holds the URL of the pull request. This URL is used to specify on which pull request the comment should be posted.
 - --body "Welcome to the repository!" specifies the content of the comment.

YAML file: another example

```
build:
  name: Post welcome comment
  runs-on: ubuntu-latest
  steps:
    - run: gh pr comment $PR_URL
      --body "Welcome to the repository!"
  env:
    GITHUB_TOKEN: ${secrets.GITHUB_TOKEN}
    PR_URL: ${github.event.pull_request.html_url}
```

Environment Variables-

GITHUB_TOKEN:GITHUB_TOKEN is used to authenticate with GitHub to carry out actions that require GitHub permissions, such as commenting on a pull request.

- `${ secrets.GITHUB_TOKEN }` retrieves the token from the repository's encrypted secrets. This token provides the necessary permissions to the GitHub Actions runner to interact with the repository on behalf of the user.
- `PR_URL:PR_URL` is set to the HTML URL of the pull request that triggered the workflow.
- `${ github.event.pull_request.html_url }` extracts the URL directly from the event data that triggered the workflow. This ensures that the comment is posted to the correct pull request.



Setting secrets

- Secrets allow you to store sensitive information in your organization, repository, or repository environments.
- Create secrets under Settings → Security → Secrets → Click New repository secret → In the Name field, type a name for your secret → In the Secret field, enter the value for your secret → Click Add secret.
- Example: Add an API Key as a Secret

Emoji change to README.md for testing workflow #2

Edit Code

Open bharatz21 wants to merge 1 commit into main from test-workflow

Conversation 1 Commits 1 Checks 1 Files changed 1

+1 -1



bharatz21 commented 19 minutes ago

Owner

What does this PR do?

(Provide a description of what this PR does.)

Test Plan

(Write your test plan here. If you changed any code, please provide us with clear instructions on how you verified your changes work.)

Related PRs and Issues

(If this PR is related to any other PR or resolves any issue or related to any issue link all related PR and issues here.)

Have you read the Contributing Guidelines on issues?

(Write your answer here.)



Emoji change to README.md for testing workflow

Verified ✓ 62e92fb



github-actions (bot) commented 19 minutes ago

Contributor

Welcome to the repository!



Add more commits by pushing to the test-workflow branch on bharatz21/skills-hello-github-actions



All checks have passed

1 successful check

Show all checks

Reviewers

No reviews

Still in progress? Convert to draft

Assignees

No one—assign yourself

Labels

None yet

Projects

None yet

Milestone

No milestone

Development

Successfully merging this pull request may close these issues.

None yet

Notifications

Customize

Unsubscribe

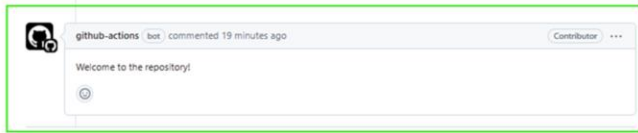
You're receiving notifications because you're watching this repository.

1 participant



Lock conversation

The Result!



GitHub Action for Continuous Integration (CI)

A workflow for linting Markdown files, generating a report in JSON format, and then uploading this report as an artifact.

```
build:
  runs-on: ubuntu-latest
  steps:
    - uses: actions/checkout@v4
    - name: Run markdown lint
      run: |
        npm install remark-cli remark-preset-lint-consistent
        npx remark . --use remark-preset-lint-consistent --frail
```

Linting is the process of running a program that analyzes code for potential errors, stylistic issues, and generally enforcing a set of rules that aim to improve the quality and consistency of the code.

The `actions/checkout@v4` is utilized to clone your project into the GitHub Actions runner, making it possible to execute subsequent operations on your repository files. The `npm install` command is used to install three NPM packages that are necessary for linting the Markdown files. `npx remark` is executed to lint all Markdown files using the specified preset and plugin.

Failing GitHub Action with logs

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

← Create ci.yml #1

Re-run jobs ⋮

Summary

Jobs

build

Run details

Usage

Workflow file

```
build
failed 27 minutes ago in 11s

> Set up job
> Run actions/checkout@v4
> Run a one-line script
> Run a multi-line script
> Run markdown lint

  Run npm install remark-cli remark-preset-lint-consistent
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  2
  3 added 198 packages in 7s
  4
  5 192 packages are looking for funding
  6   run "npm fund" for details
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Generating and uploading test reports

When the work product of one job is needed in another, we can use the built-in [artifact storage](#) to save artifacts created from one job to be used in another job within the same workflow.

GitHub Action for Continuous Integration (CI)

```
build:
  runs-on: ubuntu-latest

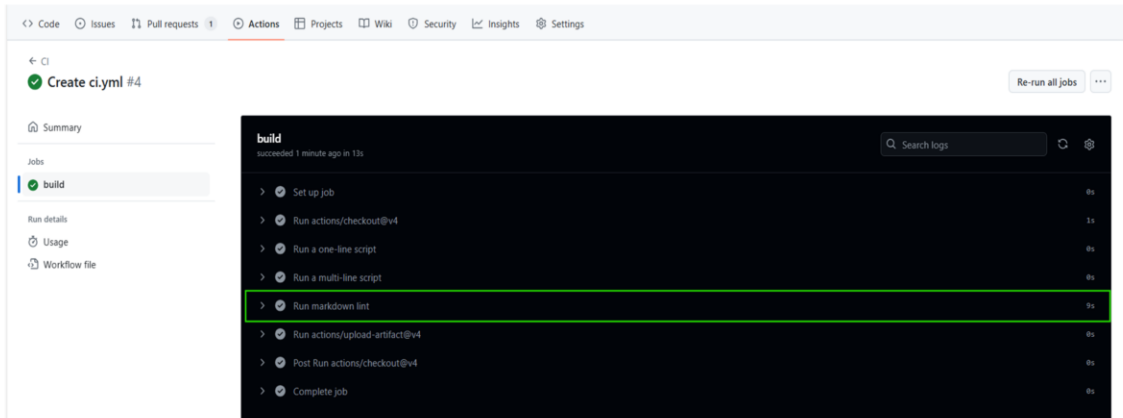
  steps:
    - uses: actions/checkout@v4

    - name: Run markdown lint
      run: |
        npm install remark-cli remark-preset-lint-consistent vfile-reporter-json
        npx remark . --use remark-preset-lint-consistent --report vfile-reporter-json 2> remark-lint-report.json

    - uses: actions/upload-artifact@v4
      with:
        name: remark-lint-report
        path: remark-lint-report.json
```

The output, which normally goes to standard error due to the `--report vfile-reporter-json` option, is redirected into a JSON file named `remark-lint-report.json`. After generating the lint report, the `actions/upload-artifact@v4` action uploads it to the workflow's artifacts. This file can be downloaded from the GitHub Actions run, allowing for easy access and review of the lint results.

Passing GitHub Action



This workflow is ideal for projects that require consistent style and formatting in their Markdown documentation. It ensures that all Markdown files adhere to the specified linting rules, and the lint results are made available for review through the uploaded artifact, which can improve code review processes and maintain code quality.

Summary

•GitHub Actions

- Automates software development workflows directly within GitHub. Triggered by events like push, pull requests, and scheduled times.
- Can be configured to run on various types of events with precise conditions (e.g., branches, tags).

•Components of a GitHub Actions Workflow

- Workflows:** Define automated processes from start to finish.
- Jobs:** Collections of steps within a workflow.
- Steps:** Individual tasks within a job, executed sequentially.
- Actions:** Reusable units of code that perform specific functions in a step.

•Secrets in GitHub Actions

- Used to store sensitive information securely. Configurable at repository or organization levels.
- Critical for maintaining security, especially with API keys and access tokens.

•Practical Implementation: Benefits of GitHub Actions

- Efficiency:** Automates repetitive and complex tasks, reducing manual effort and increasing productivity.
- Reliability:** Ensures consistent execution of deployment and testing workflows, minimizing human errors.
- Scalability:** Easily integrates with existing tools and services, supporting both small projects and large-scale operations.
- Customization:** Highly customizable to meet specific project needs, from simple notifications to full CI/CD pipelines.

Git/GitHub Quiz

