Task 3: Version Control With Git/GitHub

1. Which type of Git object is used to store the contents of a file and how this object fits into Git's object model?

Git uses a **blob object** to store file contents. Blobs hold raw data of files, trees organize blobs into directories, and commits point to trees to represent full project snapshots.

2. Git allows configuration at system, global, and local levels. Explain which level takes priority if the same setting is defined in multiple places, and why this design is useful.

Priority order: **Local > Global > System**. This is useful because repository-specific settings can override user or system defaults, ensuring flexibility for different projects.

3. Compare `.gitignore` and `.git/info/exclude`. How are they similar, and in what situations would you use one instead of the other?

Both prevent Git from tracking specified files.

- `.gitignore`: stored in the repo and shared with the team.
- `.git/info/exclude`: local-only, not shared.
  Use `.gitignore` for project-wide rules, and `exclude` for personal or temporary ignores.

4. What is the difference between `git diff` and `git diff --staged`? Describe a scenario where each command would be useful.

- `git diff`: shows unstaged changes (working directory vs index).
- `git diff --staged`: shows staged changes (index vs last commit).
  Scenario: use `git diff` to review edits before staging, and `git diff --staged` to check what will be committed.

5. If you accidentally staged a file, how would you remove it from the staging area but keep your modifications in the working directory? Explain why this might be necessary.

Use:

```
git restore --staged filename
```

or

```
git reset HEAD filename
```

This keeps changes in the working directory but removes them from staging. It is necessary if you staged something by mistake but are not ready to commit it.

6. Can you directly alias `git commit` as `git ci` using Git configuration? Why or why not? If not, what alternatives exist?

Yes, with:

```
git config --global alias.ci commit
```

Git does not have a built-in `ci` command, but aliases provide a simple alternative.

7. What does the `init.defaultBranch` setting control in Git, and why might teams choose to set it differently?

It controls the default branch name when initializing a new repository. Teams set it to `main`, `develop`, or other names to match their workflow or organizational standards.

8. Every commit in Git points to at least one tree object. Explain what this means and why it is important for Git's structure.

A commit references a **tree object**, which records the directory structure and file contents at that snapshot. This is important because it allows Git to store complete project states, not just individual file changes.

9. If you have staged changes in `main` and then switch to a feature branch, what happens to those staged changes? Why does Git behave this way?

The staged changes remain staged. This happens because the staging area (index) is global, not tied to a specific branch, preventing loss of work.

10. Both `git switch -c feature` and `git checkout -b feature` create a new branch. Explain the difference between these two commands and why Git introduced switch.

Both commands create and switch to a new branch. The difference is that `checkout` is older and multi-purpose (can switch branches or restore files), while `switch` is newer and dedicated to branch operations. Git introduced `switch` to reduce confusion and improve usability.

MCQ Questions:

1. Which of the following is NOT a benefit of using version control?
c) Automatic bug fixing

2. In a Centralized Version Control System (CVCS), where is the version database stored?
b) On a single central server

3. Who developed Git and in which year?
b) Linus Torvalds, 2005

4. Which command checks the installed version of Git?
c) git --version

5. Which term refers to copying an existing remote repository to your local machine?
c) Clone

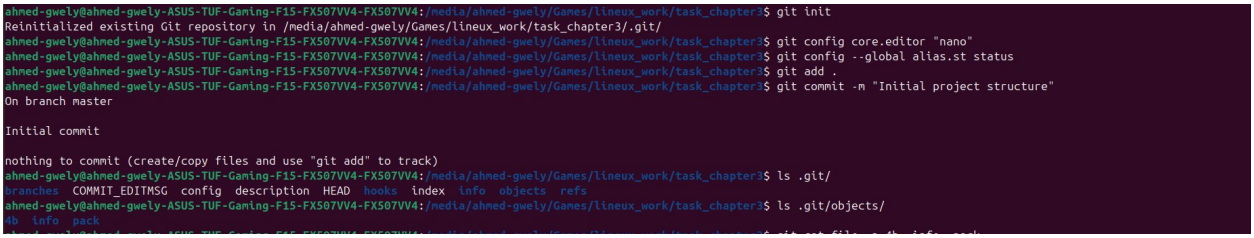
6. Which area in Git acts as an intermediate space between the working directory and the repository?
b) Staging area (index)

7. Which command renames the current branch to main?
b) git branch -M main

8. Which command is used to download a remote repository for the first time?
a) git clone

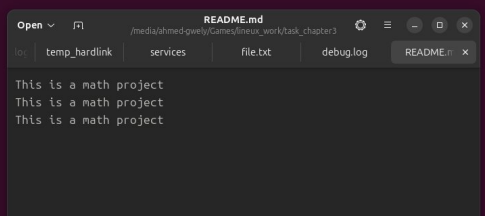
9. What is the purpose of a pull request in GitHub?
b) To suggest merging changes from one branch into another

10. If Peter wants to push changes to Daniel's repository but doesn't have permission, what must Daniel do?
b) Add Peter as a collaborator



```
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ *.log
*.log: command not found
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ *.log
*.log: command not found
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ ls .git/objects/
4b  info  pack
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ echo "debug info" > debug.log
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git status
On branch master

No commits yet

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        debug.log

nothing added to commit but untracked files present (use "git add" to track)
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git switch -c feature-math
Switched to a new branch 'feature-math'
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ mkdir -p utils
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ nano utils/math_utils.py
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ nano utils/math_utils.py
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git add utils/math_utils.py
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git commit -m "Add add() function"
[feature-math (root-commit) 4d2f2b5] Add add() function
 1 file changed, 3 insertions(+)
 create mode 100644 utils/math_utils.py
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git switch main
fatal: invalid reference: main
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git merge feature-math
Already up to date.
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git log --oneline --graph --decorate --all
* 4d2f2b5 (HEAD -> feature-math) Add add() function
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$
```

```
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ echo "This is a math project" >> README.md
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git status
On branch feature-math
Untracked files:
  (use "git add <file>..." to include in what will be committed)
        README.md
        debug.log

nothing added to commit but untracked files present (use "git add" to track)
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git restore README.md
error: pathspec 'README.md' did not match any file(s) known to git
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git status
On branch feature-math
Untracked files:
  (use "git add <file>..." to include in what will be committed)
        README.md
        debug.log

nothing added to commit but untracked files present (use "git add" to track)
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ echo "temp.txt" >> .git/info/exclude
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$ git log --oneline --graph --decorate --all
* 4d2f2b5 (HEAD -> feature-math) Add add() function
ahmed-gwely@ahmed-gwely-ASUS-TUF-Gaming-F15-FX507VV4-FX507VV4:/media/ahmed-gwely/Games/lineux_work/task_chapter3$
```



Thanks For Reading