A Java course

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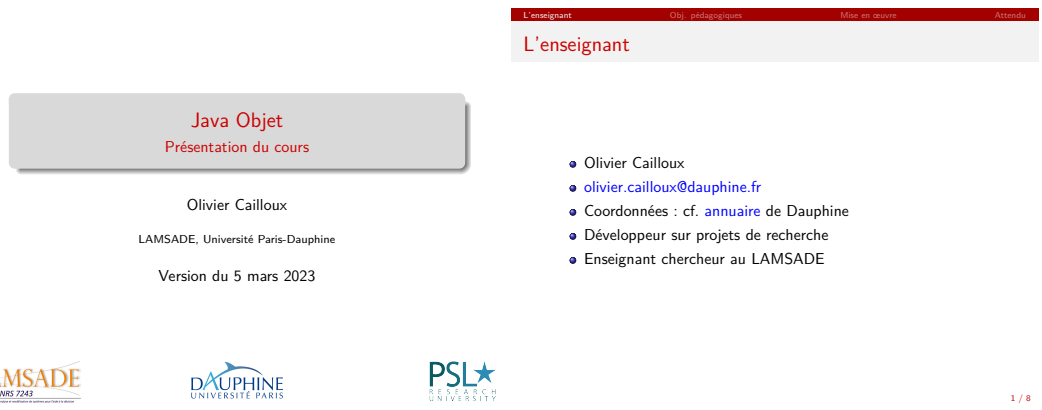
1. Presentation

Présentation[1]



[1] https://github.com/oliviercailloux/java-course/raw/main/L3/Pr%C3%A9sentation%20du%20cours%20Objet/presentation.pdf

Objectifs pédagogiques

- Programmer de « vraies » applications
- De qualité
- Fournir et utiliser des composants réutilisables
- Conception objet
- Prise en main d'outils de dév avancés :
  - Eclipse ;
  - Maven ;
  - git (livraisons exclusivement via GitHub)

Intérêt pratique

- Technologies omniprésentes et très demandées (15 In-Demand Tech-Focused (And Tech-Adjacent) Skills And Specialties, 2022, Forbes Technology Council)
- Qu'on soit programmeur, qu'on discute avec des programmeurs
- Décomposition en responsabilités, en sous-problèmes
- Respect des spécifications
- Utile au-delà de la programmation

Prérequis

- Notions algorithmiques élémentaires (boucles, structures de listes, d'arbres...)
- Familiarité avec un langage tel que C++ ou Python
- Manipulation de votre système d'exploitation : installation de logiciels, navigation dans le système de fichiers, démarrage de programmes
- Capacité à comprendre des textes en anglais liés à l'informatique
- Un ordinateur fonctionnel

Évaluation

100% CC

- Tests réguliers en séance (annoncés)
- (Possible selon avancement) Devoirs maison / Remises de projet
- (Possible selon avancement) QCMs
- Aggrégation des notes reçues au long de l'année
- Pondération augmente au fil de l'année

Évaluation des tests

- Code doit compiler
- Livraison via git
- Respect précis des instructions
- Évaluation généralement automatique
- Points pour chaque aspect fonctionnel

Contenu

- Syntaxe Java
- Programmation objets : responsabilités ; techniques
- Maven
- Éléments d'ingénierie : programmation par contrat ; patrons de conception...
- Collections
- Tests unitaires
- Utilisation de bibliothèques tierces
- Exceptions
- Logging
- Et plus selon demandes

Travail attendu

- $\{[(25\text{ h} / \text{ECTS}) \times 5\text{ ECTS}] - 51\text{ h}\} / 16$ inter-séances
- 5 heures de travail entre chaque séance en moyenne
- Prenez des notes
- Poursuivre les exercices chez vous, cf. page GitHub du cours

2. Shell

2.1. Introduction

A shell (also called a terminal or a command line interface) permits to invoke programs by typing commands.

- Under Linux, use BASH (Bourne-again Shell), for example.
- Under Windows, choose one of these routes.
  - Install git[2]; use Git BASH (recommended for beginners);
  - use (Windows) PowerShell[3], which is probably installed already (recommended for power users).
- (Different shells admit slightly different syntax and provide slightly different capabilities, and commands sometimes differ, but the commands we will need for this course are the same in most classical shells, except when indicated.)

2.2. Basics

Read Introduction to command line[4] for the very basics of using a shell. Use ↑ (keyboard up arrow[5]) to reuse previous commands. (This tutorial[6] could help as well.)

At the end of this part you are supposed to be able to use a shell to, at least, change directory and list files.

2.3. About arguments

A shell command contains (typically) a program name, followed by arguments, separated by spaces. Example: `touch afile anotherfile` calls the program `touch` with two arguments. This command creates two empty files, `afile` and `anotherfile`, if they do not exist already.

Any argument can be surrounded by quotes, thus, the commands `touch "afile" "anotherfile"` or `touch afile anotherfile` or `touch "afile" anotherfile` are equivalent to the previous one. *However*, to form a single argument containing spaces, quotes are *mandatory*. Example: `touch "a file" "another file"` contains two arguments: `a file` and `another file`. Thus, this command creates two files, named `a file` and `another file`, with spaces in their names. The command `touch a file another file` (without quotes) would instead create four files.

Here are other examples for better understanding what an argument is: the command `ls -a` has one argument, `-a`. It is equivalent to `ls "-a"`. The command `ls --color=always "a file"` has two arguments. It is equivalent to `ls "--color=always" "a file"`. The command[7] `git config --type bool --get core.filemode` has five arguments (considering `git` as the program name and `config` as its first argument).

2.4. Exercice

Open a shell, navigate (using `cd`) to some different place of your choice on your hard disk, create a file `my file.txt` there (using the shell), delete it with your graphical file explorer, check in the terminal that it has disappeared (using the shell).

[2] https://git-scm.com/download
[3] https://docs.microsoft.com/powershell/scripting/install/installing-windows-powershell
[4] https://tutorial.djangogirls.org/en/intro_to_command_line/
[5] https://en.wikipedia.org/wiki/Arrow_keys
[6] https://www.lamsade.dauphine.fr/~bnegrevergne/ens/Unix/static/TP_Shell_Unix.pdf
[7] https://git-scm.com/docs/git-config

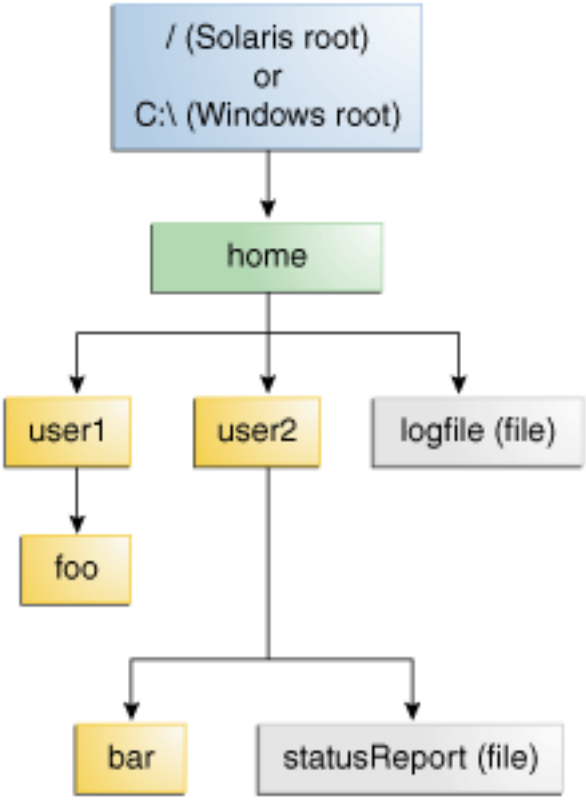
2.5. Relative and absolute paths

It is often necessary to refer to files or directories as arguments to commands in the terminal. You do this usually by using absolute or relative file or directory paths.

A file or a directory stored on your hard disk has an absolute “path” (or, less technically, “name”) that refers to it unambiguously. For example, under Linux (or MacOS): `/home/user2/statusReport`; and under Windows: `C:\Documents\myprojectdirectory\README.txt`. (Windows uses backslashes instead of slashes to separate path names and a slightly different naming scheme.) Examples in this course follow the Linux-like naming.

The term “path” comes from the fact that this way of referring to files correspond to following a path in a tree that represents the hierarchy of files on your file system. In the file system displayed below (from Oracle tutorial[8]), a file has the path `/home/user1/foo`, for example.

Figure 1. A tree representing a file system



A file or a directory can also be referred to using a path that is *relative* to another directory. For example, relative to the directory `/home/user2/`, a relative path for the file in the above example is `statusReport`. A path relative to `/home/` is `user2/statusReport`. Relative paths can also use `..` segments to “climb up” one level in the hierarchy. That is, relative to `/home/user2/bar/`, a path of the example file is `../statusReport`. The mechanism for referring to directories using relative paths is similar. For example, a relative path to refer to the directory `/home/user2/bar/`, relative to `/home/`, is `user2/bar/`. A relative path never starts with a `/`, an absolute path always does (this is also true under Windows, if replacing `/` with `\` and neglecting the drive letter).

Referring to some file or directory as an argument of a command typed in a terminal can usually be done using its absolute path or its path relative to your current directory. For example, if you are in the directory `/home/user2/`, you can use both `/home/user2/statusReport` or `statusReport` to refer to the same file.

[8] https://docs.oracle.com/javase/tutorial/essential/io/path.html

You can use the special name `.` to refer to the current directory. For example, you can use `ls somepath` to list the content of the directory specified by `somepath`, and thus typing `ls .` lists the content of your current directory.

This course uses Linux-like commands (in particular, uses forward slashes to separate paths), which you should be able to use in any of the environments listed here above: Git BASH emulates a Linux environment and PowerShell authorizes[9] this use.

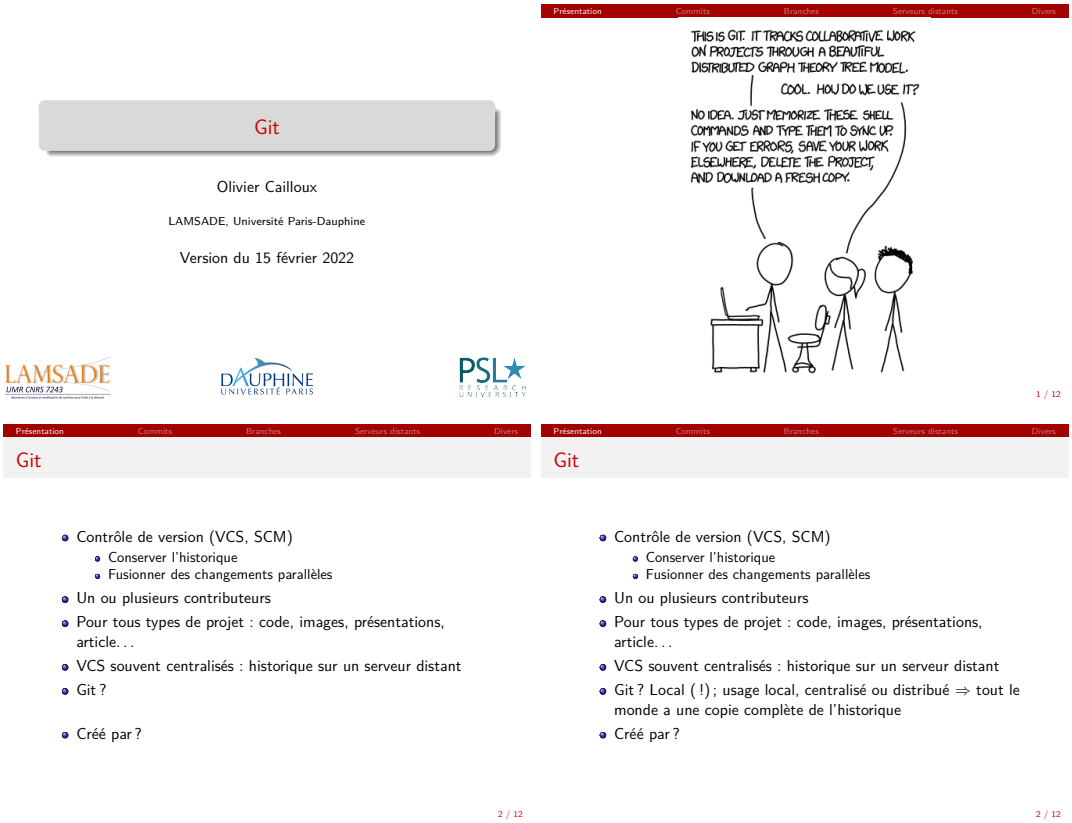
2.5.1. Exercice

Open a shell, navigate (using `cd`) to some directory of your choice `D1`. Use `ls` to list the content of a directory `D2` that is not a subdirectory of `D1`, using an absolute name for `D2`, then using a relative name. Still from `D1`, create a file in `D2`, using `touch`, by using an absolute file name as argument, then using a relative file name as argument.

3. Git

3.1. Presentation

Présentation[10]



[9] https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/about/about_path_syntax
[10] https://github.com/oliviercailloux/java-course/raw/main/Git/Pr%C3%A9sentation/presentation.pdf

Git

- Contrôle de version (VCS, SCM)
  - Conserver l'historique
  - Fusionner des changements parallèles
- Un ou plusieurs contributeurs
- Pour tous types de projet : code, images, présentations, article...
- VCS souvent centralisés : historique sur un serveur distant
- Git ? Local (!) ; usage local, centralisé ou distribué ⇒ tout le monde a une copie complète de l'historique
- Créé par ? Linus Torvalds (?)

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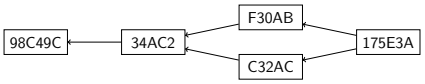
- Créé par ? Linus Torvalds (?) Créateur du noyau Linux

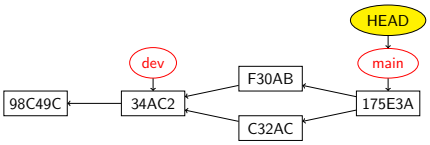
Commits et historique

- Blob : capture d'un fichier à un moment donné
- Commit : identifié par un hash SHA-1
  - Contient : structure de répertoires ; *blobs* ; auteur...
- Histoire : un DAG de « commits »
- Conservée dans un *dépôt* (repository)



Circuler dans l'historique

- Références git (git refs) : branches et références spéciales
- Références pointent vers des commits ou vers d'autres refs
- Branche : pointe un commit
- HEAD : pointe un commit, et généralement une branche ; appelés *actuels*
- Indique le commit d'où est issu la version actuelle
- Circuler en utilisant la commande `checkout <branche>`



Work dir (WD)

- Histoire conservée *localement* dans `.git` à la racine du projet
- WD (« work dir ») : version du projet (fichiers et sous-répert.)
- Interaction avec sous-rép. `.git` via commandes git

```
/root
    /.git
    /rép1
        /fich1
    /fich2
```


Préparer un commit

```
Work dir          Index          HEAD
    /rép1                            /rép1
        /fich1'                          /fich1
    /fich2'          /fich2'         /fich2
    /fich3
```

- *Index* : changements à apporter au prochain commit
- *HEAD* : état capturé dans le commit référencé
- Initialisation nouveau dépôt ?
- Juste après un commit ?

Préparer un commit

```
Work dir          Index          HEAD
    /rép1                            /rép1
        /fich1'                          /fich1
    /fich2'          /fich2'         /fich2
    /fich3
```

- *Index* : changements à apporter au prochain commit
- *HEAD* : état capturé dans le commit référencé
- Initialisation nouveau dépôt ? Index et HEAD vides
- Juste après un commit ?

Préparer un commit

```
Work dir          Index          HEAD
    /rép1                            /rép1
        /fich1'                          /fich1
    /fich2'          /fich2'         /fich2
    /fich3
```

- *Index* : changements à apporter au prochain commit
- *HEAD* : état capturé dans le commit référencé
- Initialisation nouveau dépôt ? Index et HEAD vides
- Juste après un commit ? Index vide

Présentation Commits Branches Serveurs distants Divers

Préparer un commit : commandes

- `git add fichier` : blob mis dans index (« staged »)
- `git status` : liste untracked, tracked-modified, staged
- `git status --short` (sauf merge conflict) : idx VS HEAD ; WD VS idx.
- `git diff` : WD VS index
- `git diff --staged` : index VS HEAD
- `git commit` : commenter et expédier ! (Renvoie son id SHA-1)
- `git commit -v` : voir l'index en détail
- NB : commit bouge la branche actuelle

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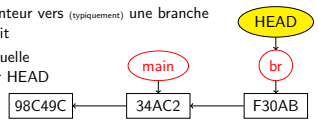
Présentation Commits Branches Serveurs distants Divers

Branches et HEAD

- Branche : pointeur vers un commit
- HEAD : pointeur vers (typiquement) une branche et un commit
- Branche actuelle désignée par HEAD



- commit : avance HEAD et branche actuelle
- `git branch truc` : crée branche `truc`. HEAD inchangé !
- `git checkout truc` : change HEAD et met à jour WD

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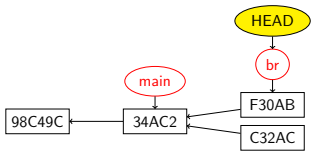
Présentation Commits Branches Serveurs distants Divers

Fusion de branches



- `git merge autrebranche` : fusionne changements de `autrebranche` dans branche actuelle
- Si `autrebranche` est en avant de l'actuelle : « fast-forward »
- Sinon, « merge conflict » possible. Modifier les fichiers à la main et les ajouter à l'index puis commit pour créer un merge.
- checkout d'un commit (ou tag) sans branche (detached head state) : lecture !

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Présentation Commits Branches Serveurs distants Divers

Serveurs distants

- `git remote -v` : montrer les correspondants distants
- `git push` : envoyer historique au dépôt distant origin
- `git fetch` : récupère les commits distants (met à jour (ou crée) les références distantes)
- Réf. distante (« remote ref ») : branche `origin/branch` ou tag qui reflète branche sur dépot distant
- « Remote-tracking branch » : branche locale qui connait son correspondant distant
- `git branch -vv` : branches et leurs correspondants distants
- `git push origin mabranche` : sinon, nouvelles branches restent locales
- `git remote show origin` : voir les réf. distantes
- Suivre une branche distante `origin/br` : `checkout br`

Illustration

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Présentation Commits Branches Serveurs distants Divers

Divers

- Utilisez gitignore (modèles)
- Créez-vous une paire clé publique / privée
- Raccourcis : à éviter au début
- `git init` : dépôt vide dans rép. courant (rien n'est traqué)
- `git clone url` : cloner un dépôt
- `git stash` : WD ← HEAD
- `git tag -a montag` (tag annoté, recommandé) puis `git push origin montag`
- `git config --global` : écrit dans `~/.gitconfig`
- Indiquez propriété `user.name` (et `user.email`)
- Déterminer des révisions exemple : HEAD~1 pour parent de HEAD
- Alias
- GUI pour diff : `git difftool`
- GUI pour merge : `git mergetool`

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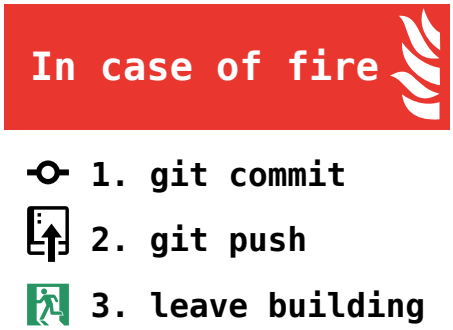
Présentation Commits Branches Serveurs distants Divers



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3.2. Introduction

Prerequisites:

- Install git[11].
- We will start learning with the command line interface of git. If you are not used to using a shell, read the Shell[12] document. Under Windows, use Git BASH which provides completion. (Power users may prefer to use PowerShell[13] with posh-git.)

Then see:

- présentation[14] (or read below),

[11] https://git-scm.com/download
[12] https://github.com/oliviercailloux/java-course/blob/main/Git/Shell.adoc
[13] https://www.develves.net/blogs/asd/articles/using-git-with-powershell-on-windows-10/
[14] https://raw.githubusercontent.com/oliviercailloux/java-course/main/Git/Pr%C3%A9sentation/presentation.pdf

- configure[15] git,
- step-by-step exercices[16],
- Git branching 1[17], Git branching 2[18], Git branching 3[19]
- best practices[20].

3.3. Learning the basics

There are two ways to learn the basics of Git: the frustrating and long way, and the nice and short way. The frustrating and long way is the one you find yourself into if you do not read anything about git (because you do not have time) and just try to deal with it by running commands that you found on the web, that you do not fully understand, that you supposed would achieve just what you need, and that instead created a mess that you ignore how to repair.

To save time, read the Pro Git[21] book. For the basics, you really only need to read the following sections.

- 1.3[22] What is Git?
- 1.6[23] Getting Started - First-Time Git Setup
- 2.1[24] Getting a Git Repository
- 2.2[25] Recording Changes to the Repository
- 2.3[26] Viewing the Commit History
- 2.5[27] Working with Remotes
- 3.1[28] Git Branching - Branches in a Nutshell
- 3.2[29] Git Branching - Basic Branching and Merging
- 3.5[30] Git Branching - Remote Branches

Hint: do not try to remember all the shortcut commands and options git provides. You just need those ones: `git config --global` … (just for the initial configuration); `git clone <url>` or `git init` to start the fun; `git status`, `git diff`, `git add <files>`, `git commit` and `git merge` to enrich your local history; `git branch <name>` to create branches; `git log` and `git checkout <branch/commit>` to navigate your history; `git fetch` and `git push` to synchronize with your remote repository. You can learn the rest when and if you need it.

3.4. Configure git

Git can be configured by associating string values to “options”. An option can be configured locally (for a given repository) or globally (for every time you use git on that system).

[15] https://github.com/oliviercailloux/java-course/blob/main/Git/README.adoc#configure-git
[16] https://github.com/oliviercailloux/java-course/blob/main/Git/Step-by-step.adoc
[17] https://github.com/oliviercailloux/java-course/blob/main/Git/Git%20branching%201.adoc
[18] https://github.com/oliviercailloux/java-course/blob/main/Git/Git%20branching%202.adoc
[19] https://github.com/oliviercailloux/java-course/blob/main/Git/Git%20branching%203.adoc
[20] https://github.com/oliviercailloux/java-course/blob/main/Git/Best%20practices.adoc
[21] https://git-scm.com/book
[22] https://git-scm.com/book/en/v2/Getting-Started-What-is-Git%3F
[23] https://git-scm.com/book/en/v2/Getting-Started-First-Time-Git-Setup
[24] https://git-scm.com/book/en/v2/Git-Basics-Getting-a-Git-Repository
[25] https://git-scm.com/book/en/v2/Git-Basics-Recording-Changes-to-the-Repository
[26] https://git-scm.com/book/en/v2/Git-Basics-Viewing-the-Commit-History
[27] https://git-scm.com/book/en/v2/Git-Basics-Working-with-Remotes
[28] https://git-scm.com/book/en/v2/Git-Branching-Branches-in-a-Nutshell
[29] https://git-scm.com/book/en/v2/Git-Branching-Basic-Branching-and-Merging
[30] https://git-scm.com/book/en/v2/Git-Branching-Remote-Branches

- Type `git config --global --list` to see which options are currently configured globally

Here we want to associate your name as a value to the option `user.name`. Git will use this to sign your commits.

- Type `git config --global --get user.name` to see the value currently associated to the option `user.name`
- Type `git config --global --add user.name MyUserName` to associate the value `MyUserName` to the option `user.name`
- Check again the value currently associated to the option `user.name`

For more info: initial setup[31]; GitHub usage of `user.name`[32] and `user.email`[33]

3.5. About authentication on GitHub

Authentication fails if you use your GitHub password. You must use a personal access token instead. See Cloning with HTTPS URLs[34], follow the instructions to create a "fine-grained personal access token".

3.6. References

- The git Cheat sheets[35],
- The git name[36].
- Learn Git Branching tutorial[37] and live demo[38]
- Git-SCM[39]: Videos; Cheat Sheets; Book Pro Git[40] (free, as in speech and beer)
- Videos (I haven't watched any of those): see Git-SCM videos[41]; Videos by Tower[42]
- Working with git: A quick and useful guide[43] about workflow on GitHub; a branching model[44]; prefer fetch then merge[45] to pull; the scout pattern[46] for merging
- GUIs: I recommend using the one integrated with your IDE; other options include Git Cola[47] (in particular `git-cola dag`); I've been recommended GitKraken[48] (but it is only free for public repos[49]; or through GitHub Student Pack[50])

3.7. Step-by-step exercices

Some step by step exercices for git starters.

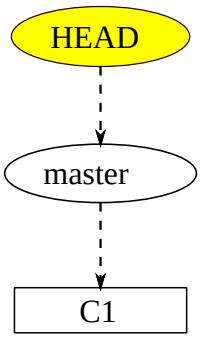
[31] https://git-scm.com/book/en/v2/Getting-Started-First-Time-Git-Setup
[32] https://docs.github.com/en/get-started/getting-started-with-git/setting-your-username-in-git#about-git-usernames
[33] https://help.github.com/en/github/setting-up-and-managing-your-github-user-account/setting-your-commit-email-address
[34] https://docs.github.com/en/get-started/getting-started-with-git/about-remote-repositories#cloning-with-https-urls
[35] https://github.github.com/training-kit/
[36] https://git.wiki.kernel.org/index.php/Git_FAQ#Why_the_.27Git.27_name.3F
[37] https://learngitbranching.js.org/
[38] https://learngitbranching.js.org/?NODEMO
[39] https://git-scm.com/
[40] https://git-scm.com/book
[41] https://git-scm.com/videos
[42] https://www.git-tower.com/learn/git/videos
[43] https://guides.github.com/introduction/flow/
[44] https://nvie.com/posts/a-successful-git-branching-model/
[45] https://longair.net/blog/2009/04/16/git-fetch-and-merge/
[46] http://think-like-a-git.net/sections/testing-out-merges/the-scout-pattern.html
[47] https://git-cola.github.io/
[48] https://www.gitkraken.com/
[49] https://www.gitkraken.com/pricing#git-gui-features
[50] https://help.gitkraken.com/gitkraken-client/gitkraken-edu-pack/

3.7.1. Local repository

3.7.1.1. First commit

- Create a new directory `project` and put there a file `start.txt` with content `hello`.
- Initialize a new git repository in your directory.
  - Hint: check in the slides, or in the Cheat sheets, how to do this.
- Put `start.txt` in the index. Modify its content so that it contains `hello2`. Observe (using a git command) the difference between the version of this file in the workdir, in the index, and in the repository (all three should be different). Now place your new version of `start.txt` in the index.
- Send your first commit. (Where is it sent?) Check that your current situation conforms to Figure 2, “Right after the first commit”.
  - Hint: try both commands `git log` and `git log --graph --oneline --decorate --all`, understand how they differ.
  - Also: install Git Cola[51] and use the command `git-cola dag` to view your history graphically.

Figure 2. Right after the first commit

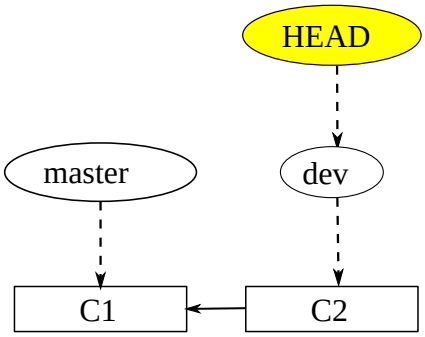


3.7.1.2. First branch

You have got a bold idea to solve some problem in your project. But you’re not so sure it will work. You want to create a branch and modify things there in the meantime.

- Create a branch `dev`. Commit in this branch a file `bold.txt` containing `try 1`. Thus, your new commit contains two files (`bold.txt` and `start.txt`). Check that your current situation conforms to Figure 3, “A commit and another commit in a branch”.

Figure 3. A commit and another commit in a branch



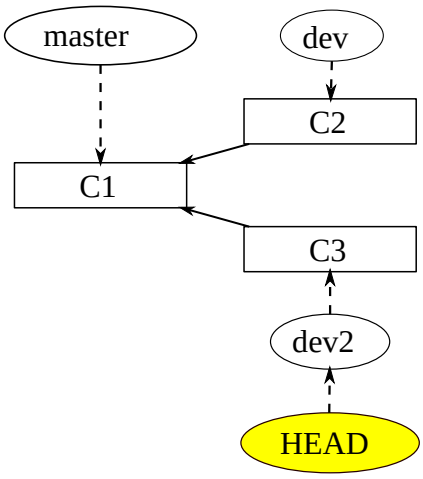
[51] https://git-cola.github.io/

3.7.1.3. Second branch

Now that this (huge) work is done, you want to try an alternative approach. You're also not sure, so you'll do it in a different branch.

- Starting back from `master`, create a branch `dev2`. Commit in this branch a file `bold.txt` containing `alternative approach` and a file named `supplement.txt` containing `hello suppl`. Check that your current situation conforms to Figure 4, "Two branches plus master".

Figure 4. Two branches plus master



3.7.1.4. Merge

Thinking about it, you decide to merge both your ideas into `master`.

- Go back to branch `master` and merge `dev` into it. Before doing it, try to predict the resulting situation, and whether it will produce a fast-forward.

- Now let's merge `dev2` into `master` (now containing the changes from `dev`). First predict what situation will result. Try it and obtain a final result with everything merged into the `master` branch.

(Solutions diagrams are here: Merged1[52], Merged2[53]. Don't cheat! Solve the exercice before looking.)

3.7.2. Remote repository

- Clone your local repository into another directory of your same computer, in order to create another repository. Let's call your original repository R1, your new one (cloned) R2, and the respective work directories WD1 and WD2. This way we simulate multiple users, using only your computer.

  - Hint: proceed as if cloning from an url, but give it instead your local path to your repository.

- Now R2 should have remote repository named `origin` pointing to R1, and a remote-tracking branch `master`. (The term "remote" is ill-suited here, generally your remote would effectively be located on another computer.) Use git commands to see what `origin` refers to, as well as `master` and `origin/master`.

- Change the content of the file `bold.txt` into WD1 (add your first name). Commit into R1.

- Fetch the new informations from R1 into R2. Check that the last commit from R1 exists in the history of R2. Observe the difference between `git log` and `git log --all`.

[52] https://github.com/oliviercailloux/java-course/blob/main/Git/Merged1.svg
[53] https://github.com/oliviercailloux/java-course/blob/main/Git/Merged2.svg

- Predict what `master` and `origin/master` refer to in R2, and check. What is in the file `bold.txt` in R2? Why?
- Merge into R2 your last changes from R1.

3.7.3. Remote repository on GitHub

- Create a new remote remository, RG, on GitHub[54]. Connect R1 to RG.
  - Hint: understand and adapt the instructions given by GitHub.
- Send your local informations to RG. Check with a browser that they have reached GitHub.
- Clone RG into a new directory, R3. Modify a file and commit into R3. Send it to RG. Check online.
- Modify something in R1, commit. Try to send it to RG. Why is it refused? How can you effectively send your last modification online? Send it to your RG repository.
- Send your two branches `dev` and `dev2` to RG as well. Check that you see them online.

3.8. Git branching 1 exercice

A modified version of a graded exercice that was given a few years ago.

- Fork[55] this project[56] and clone your version locally.
- Check out the commit whose SHA-1 identifier *ends* with `6a341`. We will call this the “starting” commit.
- Create and switch to a new branch, `my-branch`, departing from the starting commit.
- Change something in the `pom.xml` file. Commit into your branch (so that your commit has the starting commit as parent).
- Bring the changes of the commit that originally followed the starting commit into `my-branch` (by merging).
- Do not forget to send all your commits and your branch to the GitHub repository. Check that you see them online.

You will be graded as follows.

- One of the commits that you created must have the starting commit as parent, and be an ancestor of the final position of `my-branch`.
- One of the commits that you created must have two parents: a commit that you created; and one that you did not create; both parents having as parent the starting commit. The commit must be the final position of the branch `my-branch`, or be an ancestor of it.
- You must have changed the pom in your commit that has the starting commit as a parent.
- Commits created using the GitHub web site do not count.

4. Graded exercices

This document explains how to submit your solutions for the graded exercices of this course.

- Each graded exercice uses its own “GitHub assignment” (a mechanism proposed by GitHub classroom to dispatch exercices in a class).

[54] https://github.com/
[55] https://docs.github.com/en/get-started/quickstart/fork-a-repo
[56] https://github.com/oliviercailloux/google-or-tools-java

- Each assignment has its own name and link. Start by clicking the link and accept the assignment
  - This creates a GitHub repository that you own in my GitHub “organisation”, `oliviercailloux-org`
  - Your repository will be created as `https://github.com/oliviercailloux-org/assignmentName-yourGitHubUserName`
  - This repository will be initialized with some data
- Clone your new repository
  - You have to work on your local repository, and regularly push your additions to the remote
  - Both you and I have access to your remote repository. I use this access to grade your work
  - Note that I have no access to your local repository, so, whatever you do not push, I cannot grade
- Do whatever the assignment asks you to do (for example, add some code to some files, create new files, …) in your local repository
- Push your work to your remote
  - Push regularly, do not wait the end of the allowed time, so as to prevent last minute problems
- Hint: Check with the GitHub web interface that your commits and branches have reached the remote repository

4.1. Configuration

It is important that your git `user.name` equals[57] (exactly) your GitHub username, so that I can associate your contributions to you (this will be important when working on projects but I will also grade whether you configured your git correctly even before projects, as part of each graded exercice).

You must also apply About authentication on GitHub[58].

4.2. The `training` assignment

- Here is the link[59] for the “training” assignment.
- You should be able to predict the name of the GitHub repository that will be created when you will accept this assignment.
- You can use this to practice as much as you want.
- This repository will not be used to grade your work.
- In this assignment, you start with a file named `hello.txt` which contains `Hello, world.`

If you want to start fresh (for example, before starting a new exercice), delete[60] your “training” repository.

4.3. Exercice: hello world

Accept the `training`[61] assignment and translate the content of the file `hello.txt` to say hello in another language of your choice. Make sure this is visible on your remote repository.

[57] https://github.com/oliviercailloux/java-course/blob/main/Git/README.adoc#Configure-git
[58] https://github.com/oliviercailloux/java-course/blob/main/Git/README.adoc#About-authentication-on-GitHub
[59] https://classroom.github.com/a/uAsNcmqi
[60] https://docs.github.com/repositories/creating-and-managing-repositories/deleting-a-repository
[61] https://classroom.github.com/a/uAsNcmqi

5. Syntax

Here we learn the basic syntax of Java, and train using jshell.

See: présentation[62].

5.1. Hint

In jshell, as with many shells, use ↑ (keyboard up arrow[63]) to recall previous commands.

5.2. Short exercices

1. Assign your first name to a variable and use it to print `Hello <your-first-name>.`
2. Assign your age to a variable and use it to print `<your-age> is my age!`
3. Assign each digit of your age to different variables; use them to print `<your-age> is my age!`
4. Create a boolean variable whose value is `true`, another one whose value is `false`, and use them to create an expression that evaluates to `true` and one that evaluates to `false`
5. Assign any number you like to an integer variable. Create an expression that evaluates to `true` if, and only if, that variable equals your age. (Test it by changing the value of the variable and running the expression again.)
6. Assign the value `"true"` to a variable of type `String`. Create an expression that evaluates to `true` if, and only if, the value of that variable is equal to the String `"true"`. Use the method `s1.equals(s2)` to test for equality of two strings `s1` and `s2`.

5.3. Methods

1. Assign 4659 and 23 to variables, and show the result of multiplying these variables
2. Compute the greatest divisor of 4659 that is different than 4659 (use the `%` operator and a loop) (to check your answer, look at its factors[64])
3. Define a method that returns the greatest divisor of 4659 that is different than 4659
4. Define a method that accepts an integer parameter and returns its greatest divisor except itself; use it to show the greatest divisor of 4659.

5.4. Classes

In a text editor, define a class `MyMathClass` containing a method that accepts an integer parameter and returns its greatest divisor except itself, and a method that returns the smallest divisor of its parameter except one; and a class `MyBooleanClass` containing a method `xor` returning `true` iff exactly one of its two boolean parameters is `true`. Copy-paste this in jshell and call all these methods from jshell.

5.5. More about classes

Define a class `MovingThing` that has a static variable `currentSpeed` and a static variable `totalLength`; and a static method declared as `static void move(double time)` that com-

[62] https://raw.githubusercontent.com/oliviercailloux/java-course/master/Syntax/Pr%C3%A9sentation/presentation.pdf
[63] https://en.wikipedia.org/wiki/Arrow_keys
[64] https://www.wolframalpha.com/input?i2d=true&i=factor%5C%2840%294659%5C%2841%29

putes the distance an object moving at `currentSpeed` moves in `time` and adds it to the current total length. Copy-paste this in jshell and use your class to check that it works well. For example, after calling `MovingThing.currentSpeed = 10` then `MovingThing.move(50)`, the variable `MovingThing.totalLength` should have a value of `500`.

Once this works, make all your variables private so that nobody but your own class can touch them. Modify your class to make it still useable by providing appropriate methods to get or set their values as required. Make sure to restrict access as much as reasonable, for example, an external user should not be able to modify the `totalLength` directly.

5.6. More exercices

- **EE3.1[65] to 3.2**
- **3.6 [I]**
- EE3.8, 3.9 [O]

5.7. Varargs

See Oracle doc about the varargs syntax: Varargs[66]

Exercice: call the static method `String.format[67]()` with no arguments, then with only one string as argument, then two strings, then three strings. Predict which calls will be accepted by the compiler. Explain in each case what parameters are effectively passed to the method, by considering the method declaration (hint: exactly two parameters are passed for each permissible call).

5.8. More syntax

- Interfaces[68]
- Classes as concept[69]: instance variables and instance methods
- Inheritance[70]: extending interfaces and classes

5.9. References

- jshell[71]
- The peculiarities of the JShell[72]

[65] https://math.hws.edu/javanotes/c3/exercises.html
[66] https://docs.oracle.com/javase/tutorial/java/javaOO/arguments.html
[67] https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/lang/String.html#format(java.lang.String,java.lang.Object.%2E.)
[68] https://github.com/oliviercailloux/java-course/blob/main/Syntax/Interfaces.adoc
[69] https://github.com/oliviercailloux/java-course/blob/main/Syntax/Classes%20as%20concept.adoc
[70] https://github.com/oliviercailloux/java-course/blob/main/Syntax/Inheritance.adoc
[71] https://docs.oracle.com/en/java/javase/13/docs/specs/man/jshell.html
[72] https://arbitrary-but-fixed.net/teaching/java/jshell/2017/12/14/jshell-peculiarities.html