

Installing Docker Desktop:

Docker is used to access and run the exercises through Docker Desktop. For more information, refer to the [Docker Desktop documentation](#).

Note: Make sure your computer's operating system is updated to the latest version and all the required dependencies are installed. Refer to this [guideline](#) for more information.

1. Install Docker Desktop or if already installed update to the latest version:
 - a. Mac: <https://docs.docker.com/desktop/setup/install/mac-install/>
 - b. Windows: <https://docs.docker.com/desktop/setup/install/windows-install/>
 - c. Linux: <https://docs.docker.com/desktop/setup/install/linux/>
2. Read through and follow all download instructions and open the Docker Desktop application.
3. Log in to your Docker account or create one if you do not already have one. You can use the free access level for Docker.
For any issues related to Docker Desktop installation, refer to the [Troubleshooting guideline](#) for support.

Running the Exercises:

Exercises are run using Docker Desktop and a Terminal window. An **external terminal** window can be used, or the **integrated terminal** can be directly accessed within Docker Desktop from the Docker Dashboard footer.

The integrated terminal is highly recommended to be used for Windows devices due to issues with multi-platform compatibility. If there are any issues running the exercises from an external terminal window, please default to the integrated terminal as all platforms can utilize this feature.

1. Open the Docker Desktop application.
 - a. Docker Desktop must be open for the Docker Engine to be active.
2. Set up and start a terminal window.
 - a. **Integrated terminal:** To open the integrated terminal, select the Terminal icon located in the bottom-right corner, next to the version number on Docker Desktop
 - b. **External terminal:** To use your external terminal, navigate to the General tab in Settings and select the System default option under Choose your terminal, then open a new Terminal window.
3. If you are using an external terminal, log in to Docker on the command line using the command: `docker login`
 - a. If there are any issues, you may need to run the logout command: `docker logout` then log in again: `docker login`
4. Pull the Docker container image from the Docker Hub repository. Each exercise is marked with a unique tag. You can download all the containers, but to conserve storage resources it is recommended to pull only the specific exercise you want to run. The commands for each exercise are provided below:

```
# FastLMM & GCTA
docker pull statisticalgenetics/fastlmm-gcta

# Mendelian Randomization
docker pull statisticalgenetics/mendelian-randomization

# Pleiotropy
docker pull statisticalgenetics/pleiotropy

# Plink QC & GWAS
docker pull statisticalgenetics/plink-gwas

# REGENIE
docker pull statisticalgenetics/regenie

# Regression & Plink/R
docker pull statisticalgenetics/regression-plink-r

# Basic usage
docker pull <image_name>
```

5. Once the download is complete, run the container for the exercise. Only one container can be running at a time. The commands for each exercise are provided below:

```
# FastLMM & GCTA
docker run --rm -p 8888:8888 statisticalgenetics/fastlmm-gcta

# Mendelian Randomization
docker run --rm -p 8888:8888 statisticalgenetics/mendelian-randomization

# Pleiotropy
docker run --rm -p 8888:8888 statisticalgenetics/pleiotropy

# Plink QC & GWAS
docker run --rm -p 8888:8888 statisticalgenetics/plink-gwas

# REGENIE
docker run --rm -p 8888:8888 statisticalgenetics/regenie

# Regression & Plink/R
docker run --rm -p 8888:8888 statisticalgenetics/regression-plink-r

# Basic usage
docker run --rm -p <port> <image_name>
```

Note

--rm: automatically removes the container from your system as soon as it exits or stops running
 -p: assigns the container's port to the host (8888:8888 port best for Jupyter)

6. Once the container is running, the terminal will output a link to access the exercise. Copy the provided link into a browser. This link will open a Jupyter Lab session containing the exercise in the browser.

7. Navigate to the sidebar on the left side and find the accompanying Jupyter notebook (file ending in .ipynb) and click on the notebook to view the exercise. The associated notebook for each exercise is listed below:

# FastLMM & GCTA:	fastlmm_gcta.ipynb
# Mendelian Randomization:	mendelian_randomization.ipynb
# Pleiotropy:	pleiotropy.ipynb
# Plink QC & GWAS:	PLINK_Data_QC.ipynb & PLINK_Substructure.ipynb
# REGENIE:	regenie.ipynb
# Regression & Plink/R :	Regression.ipynb & Intro_Plink_R.ipynb

Note: All notebooks are in the current directory except in the Plink QC & GWAS exercise, as the notebook is nested within the subdirectory for the associated exercise (PLINK_DataQC & Plink_substructure). For these exercises, click on each subdirectory to navigate the notebook.

8. Each notebook contains details about the exercise, including an introduction and information about the commands. Read through the text of the notebook and follow all instructions.
9. To run the commands in the cell, select the code block and either press **Shift + Enter** or click the triangle play icon () on the top toolbar of your notebook. These commands both execute the code in the cell and immediately select the next cell below it.
10. Examine the output and continue executing all the commands for the rest of the exercise.
11. After all commands are executed, answer the questions at the end of the exercise.
12. To save the notebook locally, navigate to **File** on the top toolbar then click **Download**, which exports the notebook directly to your browser's default downloads folder.
13. Once you have completed the exercise, stop the container and end the Jupyter session by closing the browser and going back to the terminal window to run the command: **Ctrl + C** (Windows/Linux) or **Control + C** (Mac)

Best Practices:

Running the exercises may require a large amount of memory and storage resources. When running the containers, it is best to close all other applications or tabs to maximize available resources for Docker.

You may delete Docker container images locally; however, if you want to access the exercise, you will need to pull the container from the Docker Hub repository again.

If you are running into issues or want to clean up your system, run **docker system prune** to remove unused Docker resources, free up disk space, and optimize system performance. For more information on managing resources, refer to this [documentation](#).

Docker Tools:

The Docker Desktop Dashboard provides Gordon, a personal AI assistant embedded in Docker Desktop, and the Docker command line interface, both of which can be used for troubleshooting or general support.