

Planning and Optimization

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Classroom Exercise 1

Exercise 1 (Setting Up Fast Downward)

The *Fast Downward* planning system is a tool that we use frequently for demos in the lecture and for exercises of the course. Your task in this exercise is to get access to the course repository as well as the planner installed and running. We describe two ways of setting up your system in the following: we start with the recommended way that uses *Vagrant* and *VirtualBox*, which should be possible on all Intel and AMD architectures. Afterwards, we point to relevant repositories and installation instructions in case you want to or have to set up your system manually. Please follow the instructions **in one** of these two possibilities.

Installation with *Vagrant* and *VirtualBox* Start by installing *Vagrant* and *VirtualBox* by following the installation instructions for your operating systems at <https://www.vagrantup.com> and <https://www.virtualbox.org>, respectively. If your operating system is Ubuntu 18.04 or 22.04, you can install both tools by running the following commands in a console:

```
$ sudo apt update
$ sudo apt install virtualbox vagrant (for Ubuntu 22.04)
$ sudo apt install virtualbox-qt vagrant (for Ubuntu 18.04)
```

With both tools installed, you can set up the virtual machine that runs the *Fast Downward* planner:

- (a) Download the Vagrant configuration file (*Vagrantfile*) from the website of the course.
- (b) Copy or move the downloaded file to an *empty* directory. Make sure that your operating system didn't add a (possibly hidden) file extension (we have seen this happen frequently on Windows).
- (c) Open a console in that directory and execute `$ vagrant up` (this may take a while).

Over the course of the semester, you'll have to interact with the virtual machine set up with *Vagrant* repeatedly. The most important commands to do so are:

- `$ vagrant up` to start the virtual machine (after the first time, this won't take as long)
- `$ vagrant halt` to stop the virtual machine
- `$ vagrant ssh` to connect to the virtual machine
- `$ exit` to disconnect from the virtual machine

You now have set up the virtual machine, cloned all relevant repositories and installed required packages and tools. You have not yet compiled the Fast Downward planner that is used for this exercise, though. To do so, connect to the virtual machine (with `$ vagrant ssh`), then

- (a) change to the directory with the Fast Downward version used for this hands-on session with

```
$ cd /vagrant/planopt-hs23/hands-on-1/fast-downward
```

- (b) compile the planner with `$./build.py`.

(c) run the planner on the original 15-Puzzle instance with

```
$ ./fast-downward.py ../gripper/domain.pddl ../gripper/problem.pddl \  
    --heuristic "h=ff()" --search "eager_greedy([h])"
```

Congratulations, you have successfully set up your system for the practical part of the exercises!

Manual Installation An alternative (which we do **not** recommend) is to install everything that is required manually. Start by cloning the following repositories:

- the repository of the course at <https://github.com/aibase1-teaching/planopt-hs23>
- the plan validator `val` at <https://github.com/KCL-Planning/VAL>
- the plan validator `INVAL` at <https://github.com/patrikhaslum/INVAL>
- the LP-solver `SoPlex` at <https://github.com/scipopt/soplex.git>

You can find the individual steps that are required to install both plan validators in the Vagrantfile. To give you an idea of what is happening in the Vagrantfile, please note that

- we are not using the latest version of `val` and `SoPlex`
- the `val` revision we use raises warnings during compilation that are treated as errors
- the produced binaries are moved to a folder on `PATH` (such that they can be executed from anywhere without providing a path to the binary)

If you manage to successfully install the validators, you still need to compile the Fast Downward planner that is used for this exercise sheet:

- (a) Change to the directory with the *Fast Downward* version used for this hands-on session. You can find it in the directory `hands-on-1/fast-downward` of the repository of the course.
- (b) Follow the instructions on how to compile *Fast Downward* at <https://www.fast-downward.org/ObtainingAndRunningFastDownward>.

When you have successfully compiled *Fast Downward*, run the planner on the original 15-Puzzle instance with

```
$ ./fast-downward.py ../gripper/domain.pddl ../gripper/problem.pddl \  
    --heuristic "h=ff()" --search "eager_greedy([h])"
```