

15-424/15-624 Lab 0 Installing Mathematica and KeYmaera

KeYmaera is an automated theorem prover that you will use for every lab assignment in this course. Mathematica is also used as a powerful backend arithmetic solver. For your convenience, we provide instructions on installing Mathematica and running KeYmaera from your own computer. However, if you are unable to do this, the lab assignments can be completed using KeYmaera from any CMU cluster with Mathematica installed (see here for a list of clusters that support Mathematica: http://www.cmu.edu/computing/clusters/software/cluster_software.html).

1. Setup KeYmaera and Mathematica

Option 1: Run KeYmaera from a CMU Mac Cluster

Download and then open the file found here:

```
http://www.ls.cs.cmu.edu/KeYmaera/keymaera-installer.jar
```

Alternatively, you may open the file via the terminal with this command:

```
$ java -jar keymaera-installer.jar
```

Skip to step 2.

Option 2: Run KeYmaera from a CMU Linux Cluster

Check that Mathematica is installed and all licenses are in proper order by opening it from the command line:

```
[user@unix1 ~]$ mathematica
```

Follow onscreen directions (if any), until the Mathematica welcome screen appears, and then exit. This only needs to be done the first time you use Mathematica.

Run the following from the command line. The `keymaera_config.tar` file automatically sets the location of Mathematica and must be saved in your home directory. The config file can be found in `lab0.zip`. Note that the unpackaged directory is the hidden directory named `.keymaera`.

```
[user@unix ~]$ tar -xvf keymaera_config.tar  
[user@unix ~]$ wget http://www.ls.cs.cmu.edu/KeYmaera/keymaera-installer.jar  
[user@unix ~]$ java -jar keymaera-installer.jar
```

The above instructions also apply to running KeYmaera remotely via linux.andrew.cmu.edu. Setup a vnc server to interact with the KeYmaera window.

Skip to step 2.

Option 3: Run KeYmaera from your personal computer.

First, install Mathematica:

Download the CMU student version of Mathematica from this url:

(NOTE: The installation file is **large**, so the download may take some time. Also, you will need to set up an account on Wolfram, and then sign in and submit an activation key request. You can complete both of these actions from the website linked in the Mathematica installation doc and the FAQ in Section 8 of this assignment.)

<http://www.cmu.edu/computing/software/all/mathematica-student/download.html>

Follow the detailed installation instructions and use the provided license key that are included as a **README** in the downloaded file.

Next, open KeYmaera:

Download it here: <http://www.ls.cs.cmu.edu/KeYmaera/keymaera-installer.jar>

Open keymaera-installer.jar.

2. Follow the installation directions and choose the most recently released version. When installation is complete, KeYmaera will launch.
3. In KeYmaera's first dialogue box, check that the Mathematica path points to the location where Mathematica is installed. Change it to point to Mathematica if it doesn't already.

On the CMU Mac clusters this should be automatic.

On the CMU linux clusters, if the keymaera_config.tar package was unpackaged correctly in your home directory, the fields should also be filled in automatically with the paths:

```
Mathematica Path: /usr/local/lib/mathematica
MathKernel Path: /usr/local/lib/mathematica/Executables/MathKernel
J/Link native dir: /usr/local/lib/mathematica/SystemFiles/Links/JLink/
                    SystemFiles/Libraries/Linux-x86-64
```

Click OK.

4. You will likely get a **Configuration Warning** since you do not have all of the possible add-ons for KeYmaera already installed. If Mathematica, MathKernel, and JLink are not listed as missing, you are probably alright. **Click Yes.**

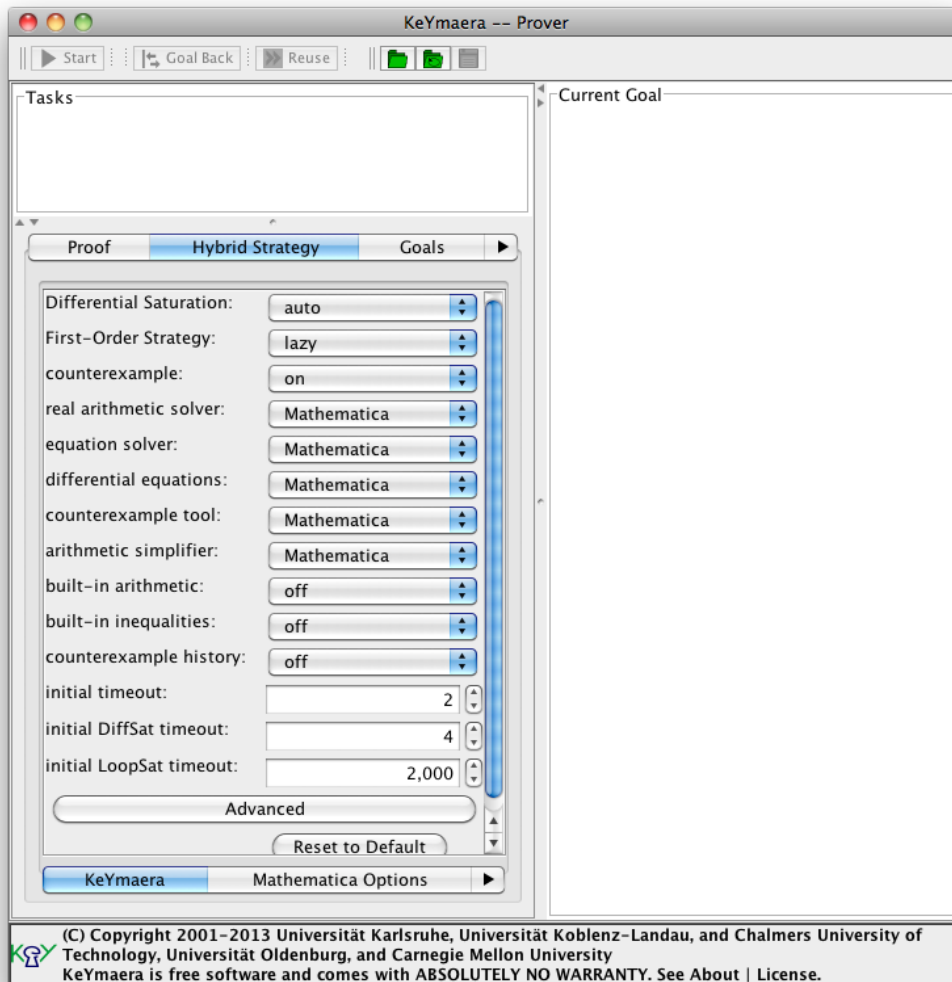


Figure 1: Mathematica should be selected as the solver for the five operations shown above.

5. After successfully opening KeYmaera, click on the **Hybrid Strategy** tab, and confirm that Mathematica is the selected solver for the five operations shown in Figure 1.

6. **Prove a property** using KeYmaera and Mathematica.

Load lab0.key (included in lab0.zip) into KeYmaera (File → Load). Click the start button. This theorem proves automatically, so after a few seconds, you will see a dialogue box that declares the property is proved and gives useful statistics, like the number of nodes and branches required. To view more statistics about your proof, like the computation time or memory usage, go to Proof → Show Proof Statistics.

Save your proof (File → Save) as lab0.key.proof.

If you would like to see more proofs or explore more of KeYmaera’s functionality, go

to File → Load Projects, to browse other projects and completed proofs.

7. Submission

For lab submissions in this course, we will use autolab (<https://autolab.cs.cmu.edu/15424-f13>). Submit the file **lab0.key.proof** in lab0.

8. Installation FAQ

Requesting a Mathematica Activation Key (Step 1, Option #3)

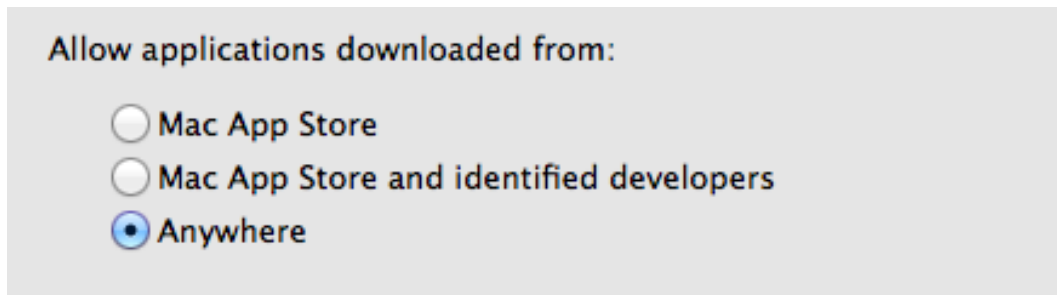
After you create an account on Wolfram, you should return to the activation key request site, sign in, and submit the form. After the form is submitted, your activation key will appear on screen and will be emailed to you. <https://user.wolfram.com/portal/requestAK/e405f7113ecb08e274cd83627f7b464ebe56cf84>

KeYmaera Installer Certificate (Step 2)

On a Mac, if you get this error about the digital signature when trying to open keymaera-installer.jar:



Go to System Preferences » Security and Privacy. Under the General tab, Allow applications downloaded from: "Anywhere."



KeYmaera on 32bit Linux: must change J/Link path manually (Step 3)

The installer/launcher nicely populates the MathKernel and the J/Link paths after entering the “Mathematica path”, but it defaults to `.../Linux-x86-64` for the J/Link path, which is not right for a 32bit machine, where the path should be `.../Linux`.

With the wrong path, the symptom is cryptic: a waiting cursor and an unfinished task after loading the `.key` file, starting the proof completes several goals, but gets stuck at “1%” (no errors in the console). Changing the J/Link path manually fixes things.