Mathematics for Decisions

AMPL and GMPL/GLPK
Installation Guide

Romeo Rizzi, Alice Raffaele

University of Verona

romeo.rizzi@univr.it, alice.raffaele@unitn.it

March 2020

Overview

How to install AMPL

- The free size-limited AMPL Demo Version (500 variables and 500 constraints for linear problems, 300 for nonlinear ones)
- Available versions for most common platforms (Windows, Linux, Mac OS X) at the following link: http://ampl.com/try-ampl/download-a-free-demo/
- Two modeling environments:
    - AMPL IDE
    - Command-line AMPL
- AMPL Demo Version already includes, among others, the following solvers:
    - CPLEX and Gurobi for linear and quadratic problems in both continuous and discrete variables;
    - CONOPT and MINOS for nonlinear problems in continuous variables.

AMPL Demo Version for Mac OS X

1. Please check to already have Java installed on your pc;
2. Download the distribution archive file named **amplide.macosx64.tgz** at this link: http://ampl.com/try-ampl/download-a-free-demo/#macosx
3. Extract its contents; by default the package will be extracted into a folder named **amplide.macosx64** that will be in your *Download* folder.
4. This will be your AMPL folder but eventually you can rename it or move it to another location, for example into the Desktop.
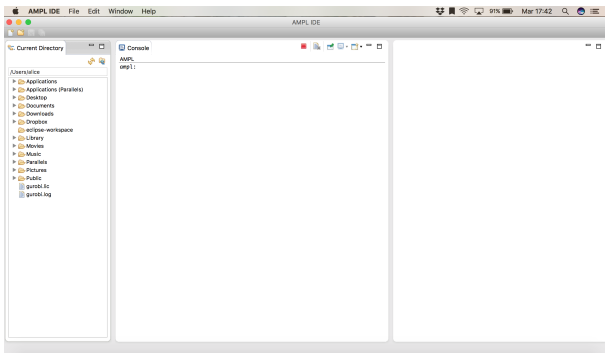
5. To run, you have to double click the **Amplide** file icon in the AMPL folder:
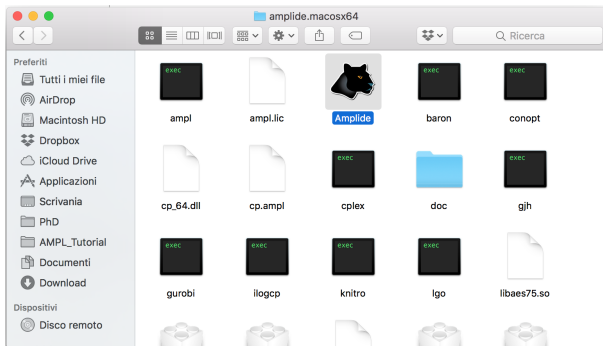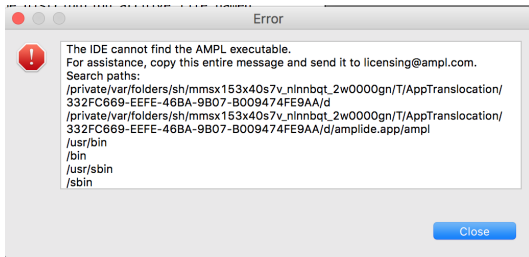
6. Loading files and workspace:


7. Finally the IDE appears:

Important note for users of Mac OS X 10.12 Sierra

- It may happen that the first time you launch the AMPL IDE,
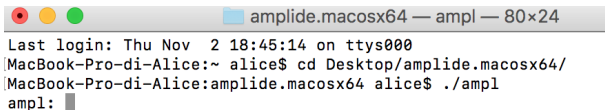 during loading of files, you get the following error message:

- It is a security issue due to the new security features
  introduced with Sierra, but it seems fixed in other versions of
  Mac OS X.

- To quickly solve it, you just need to drag the Amplide file icon and drop it to the Desktop; then drag and drop it again into the AMPL folder:
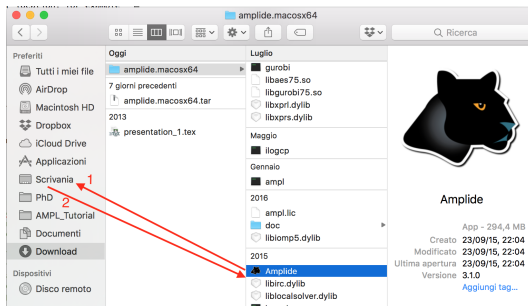
Command-line AMPL for Mac OS X

1. Open a new terminal window and go to the AMPL folder
2. Type **./ampl** and press enter: the AMPL prompt will appear

3. Now you can start using AMPL commands.

4. If you want to use AMPL from every directory, you need to edit the environment variable name $PATH. To do so, open a new terminal in your home directory.

5. Write **nano .bash_profile** to create a bash profile where to put your standard environment variables and the AMPL one.

6. Save the file pressing CTRL-X and force the script to be executed: **source ~/.bash_profile**;

7. Print the environment variable to check the edit:

AMPL Demo Version for Windows

1. Download the distribution archive file named
   amplide.mswin32.zip or **amplide.mswin64.zip**,according to
   the version of your operative system, at this link:
   http://ampl.com/try-ampl/download-a-free-demo/#windows
2. Extract contents of the main folder and also of the subfolders;
   by default the package will be extracted into a folder named
   amplide.mswinXX that will be in your *Download* folder.
3. This will be your AMPL folder but eventually you can rename
   it or move it to another location, for example into your
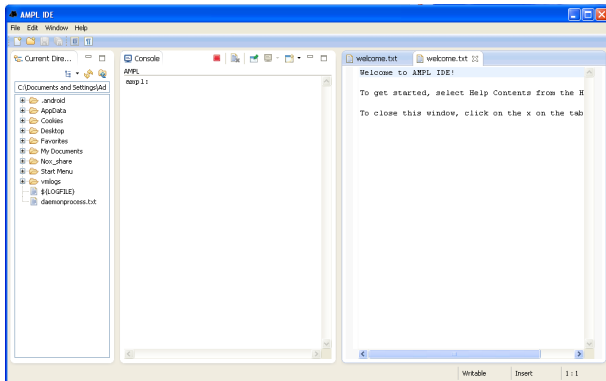   Desktop.

4. To run, you have to double click the **Amplide** file icon in the following path: **amplide.mswinXX****amplide**
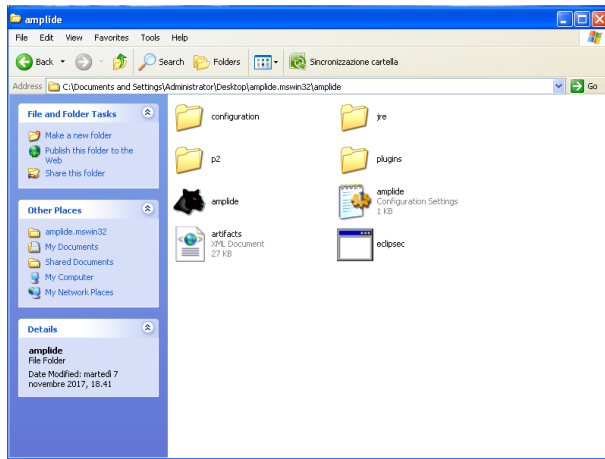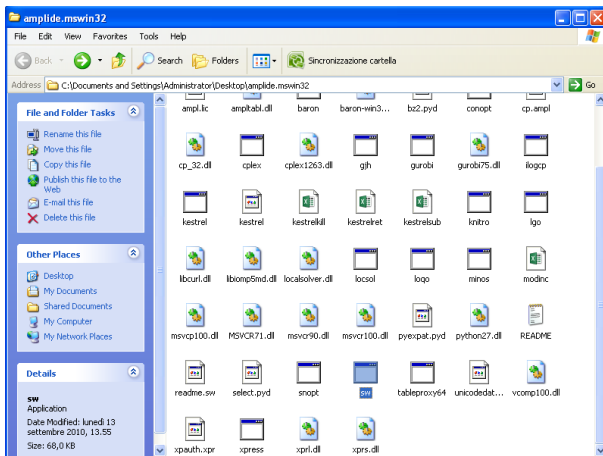
5. Loading files and workspace:

6. Finally the IDE appears:

Command-line AMPL for Windows

1. In your AMPL folder, look for **sw.exe** and double-click on it to make a prompt window appear:

2. To be able to run ampl from every directory (and not just from its one), go to Start → Computer → View system information → Advanced tab → "Environment Variables".

3. Look for "Path", click "Edit", do not erase anything but just add at the end the path to the directory where you have put ampl.exe and sw.exe.
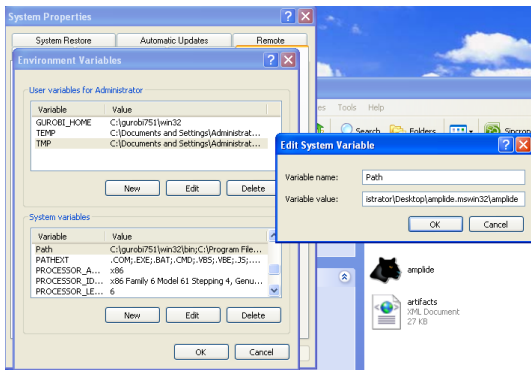
4. Open a command prompt and try to type **sw.exe** or **ampl.exe** and press enter: the AMPL prompt will appear
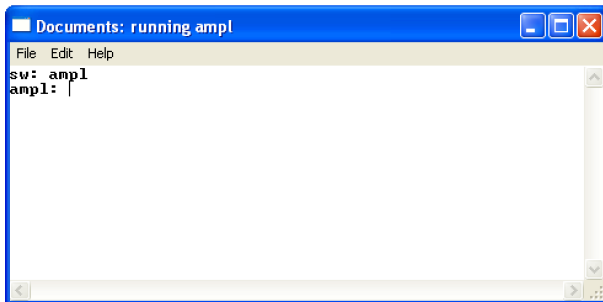
5. Now you can start using AMPL commands.

Introduction to GLPK

- GLPK (i.e., GNU Linear Programming Kit) is a software package developed in ANSI C by Andrew Makhorin (Department for Applied Informatics, Moscow Aviation Institute) for solving large-scale LP and MIP problems.
- Part of the GNU Project, actually it is a library.
- The package contains several components:
    - For LP problems: revised simplex method and primal-dual interior point method;
    - For IP problems: Branch-and-bound method and cut routines;
    - Others: translator for GNU MathProg modeling language; API; stand-alone LP/MIP solver **glpsol**

glpsol and GMPL

- Since GLPK is a library, it needs a client software where can be run exploiting GLPK APIs $\rightarrow$ The default client is the glpsol solver (GNU Linear Program Solver).
- glpsol can take **GMPL** model and data as inputs and it finds a solution as output.
- **GMPL** (i.e., GNU Math Programming Language) is a modeling language intended for describing linear mathematical programming models:
    - Like in AMPL, the model is described through **model objects** such as sets, parameters, variables, constraints and objectives;
    - The model description is composed of two parts:
        - the model section
        - the data section
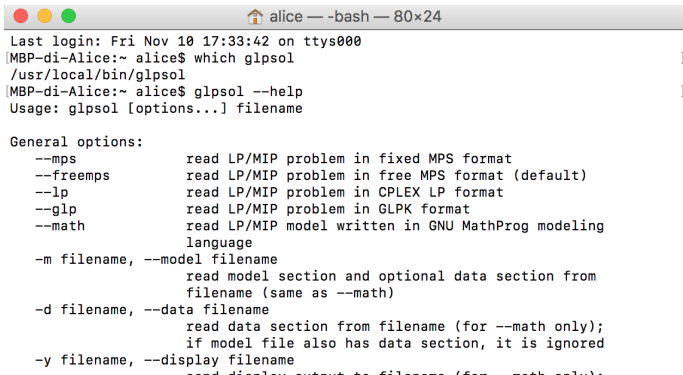   - GMPL syntax is basically the same as AMPL

GLPK for Mac OS X and Linux

1. Main page: https://www.gnu.org/software/glpk/
2. Download the lastest version of GLPK (4.65) from this link: http://ftp.gnu.org/gnu/glpk/
3. Extract the package

Index of /gnu/glpk

	Name	Last modified	Size	Description
	Parent Directory		-	
	glpk-4.63.tar.gz.sig	2017-07-25 04:17	65	
	glpk-4.63.tar.gz	2017-07-25 04:17	3.9M	
	glpk-4.62.tar.gz.sig	2017-06-14 05:30	65	
	glpk-4.62.tar.gz	2017-06-14 05:30	3.9M	
	glpk-4.61.tar.gz.sig	2017-01-22 07:56	65	

4. Open a new terminal window, go to the folder where you have extracted files and then type **./configure –prefix=/usr/local** to launch the installation on your system

5. Type **make**

6. When it is finished, type **sudo make install**

7. To verify GLPK is installed, type **which glpsol** and you should get something like this: **/usr/local/bin/glpsol**

8. Try also GLPK help: **glpsol –help**

```
● ● ●                    🏠 alice — -bash — 80×24
Last login: Fri Nov 10 17:33:42 on ttys000
[MBP-di-Alice:~ alice$ which glpsol                                          ]
/usr/local/bin/glpsol
[MBP-di-Alice:~ alice$ glpsol --help                                        ]
Usage: glpsol [options...] filename

General options:
   --mps            read LP/MIP problem in fixed MPS format
   --freemps        read LP/MIP problem in free MPS format (default)
   --lp             read LP/MIP problem in CPLEX LP format
   --glp            read LP/MIP problem in GLPK format
   --math           read LP/MIP model written in GNU MathProg modeling
                    language
   -m filename, --model filename
                    read model section and optional data section from
                    filename (same as --math)
   -d filename, --data filename
                    read data section from filename (for --math only);
                    if model file also has data section, it is ignored
   -y filename, --display filename
```

GLPK for Windows

1. Main page: http://winglpk.sourceforge.net
2. Download the latest version of GLPK (4.65) from this link: https://sourceforge.net/projects/winglpk/
3. Extract the package

4. The executables and dynamic link libraries for 32 bit (or 64 bit) Windows can be found in directory w32 (or w64).

5. Now, to be able to run glpsol, go to the folder where you have just extracted the package and then double-click on the folder *winXX* (according to your operative system version); you have two options:
   - You can copy all .dll files into %SystemRoot\%nsystem32 (for example, C:\windows\system32);
   - Otherwise, you can add the path to this *winXX* folder into the environment variable *PATH* (as you did before for AMPL).

6. If you open a command prompt, typing **glpsol** you should get information about the version (it means that the link to the dynamic libraries is working).

7. For more information:
   https://en.wikibooks.org/wiki/GLPK/Windows_executables

References

📄 AMPL
http://ampl.com

📄 AMPL: A Modeling Language for Mathematical Programming
R. Fourer, D.M. Gay, B. Kernighan
http://ampl.com/resources/the-ampl-book/

📄 GLPK
https://en.wikibooks.org/wiki/GLPK

📄 GLPK/GMPL
https://en.wikibooks.org/wiki/GLPK/GMPL_(MathProg)