Notre Dame: Pyomo Tutorial and Workshop

Summary:

Pyomo is an open-source optimization platform based on Python. It supports a diverse set of optimization capabilities for formulating, solving, and analyzing optimization models. Built on top of Python, Pyomo is embedded within a full-featured programming language, providing a rich set of scripting capabilities and supporting libraries which distinguishes it from other algebraic modeling languages like AMPL, AIMMS, and GAMS.

In this workshop, we will cover the fundamentals of modeling and scripting with Pyomo, as well as advanced features for optimization of dynamical systems and optimization under uncertainty.

Locations:

B01 McCourtney Hall

- Tuesday (all day)
- Wednesday (all day)
- Thursday (8:30 - noon)

W210 Duncan Student Center

- Thursday (noon - 4:30pm)

Tuesday, June 5, 2018

8:30 AM – 12:00 PM
Python Tutorial
Pyomo Fundamentals & Overview
Introductory Exercises

12:00 PM - 1:00 PM
Lunch Break

1:00 PM – 4:30 PM
Introduction to MIP Algorithms
"Pyomo Cookbooks" from Prof. Kantor

Wednesday, June 6, 2018

8:30 AM – 12:00 PM
Nonlinear Programming Algorithms
Introduction to IPOPT
Nonlinear Exercises
Structured Modeling and Pyomo Blocks
Transformations

12:00 PM – 1:00 PM
Lunch Break

1:00 PM – 4:30 PM
Pyomo.DAE: Dynamic Optimization
Pyomo.GDP: Sequencing and Switching
Other Advanced Capabilities of Pyomo

Thursday, June 7, 2018

8:30 AM – 12:00 PM
Pyomo.PySP: Stochastic Programming

12:00 PM – 1:00 PM
Lunch Break. Move to Duncan Student Center.

1:00 PM – 4:30 PM
Collaboration Time

Workshop Preparation

For this workshop, we will need Pyomo and some solvers that we will install using Anaconda. Anaconda is a python distribution that includes a number of packages for scientific computing. It also comes with a package manager (conda) that can be used to install a number of third-party tools.

This process involves installing and testing Anaconda, pyomo, glpk (MIP solver), and ipopt (NLP solver), and the detailed steps are given below.

1. **Install Anaconda3:**
    a. **Go to: https://www.continuum.io/downloads**
    b. **Install the Python 3.6 version for your OS. Note this is a large download (~600 MB) including Python and other packages.**
    c. **Tips for the Mac: click on the .pkg file. You might get a message indicating that the package cannot be installed because it was downloaded from the internet. Try clicking again. If this does not work, navigate to the Downloads folder, right click (control-click) on Anaconda3-…x86_64.pkg and choose "Open With…" | "Installer.app".**
2. **Test the python installation:**
    a. **On Windows, you will access Anaconda's python from the "Anaconda Prompt" application. On the mac, you will use the terminal application. Both of these are command-line interfaces that allow you to run python code. Open "Anaconda Prompt" or a terminal app.**
    b. **Type "python --version", and you should see something similar to:**
    Python 3.6.3 :: Anaconda, Inc.
    c. **Type "python". You should see something similar to:**
    Python 3.6.3 |Anaconda, Inc.| (default, Oct 6 2017, 12:04:38)
    [GCC 4.2.1 Compatible Clang 4.0.1 (tags/RELEASE_401/final)] on darwin
    Type "help", "copyright", "credits" or "license" for more information.
    >>>
    d. **Try writing some python code to test, e.g.,**
    >>> print('so…. this is python, eh?')
    e. **Type "exit()" if everything is working correctly.**

3. **Install and test Pyomo:**
    a. **From the prompt (terminal application on Mac or Anaconda Prompt on Windows) type: "conda install -c conda-forge pyomo".**
    b. **Test your pyomo installation with "pyomo --version". You should see something similar to the following:**
    Pyomo 5.3 (CPython 3.6.3 on Darwin 15.6.0)
4. **Install glpk:**
    a. **From the prompt, type: "conda install -c conda-forge glpk"**
    b. **Test the glpk solver. Type "glpsol --version". You should see something like:**
    GLPSOL: GLPK LP/MIP Solver, v4.62
    Copyright (C) 2000-2017 Andrew Makhorin, Department for Applied …
5. **Install IPOPT:**
    a. **From the prompt type: "conda install -c conda-forge ipopt"**
    b. **Test the ipopt solver. Type "ipopt --version". You should see something like:**
    Ipopt 3.12.8 (Darwin x86_64), ASL(20160307)

That's it!

Note: if you are familiar with Python and prefer to install Pyomo yourself (e.g., using pip), please make sure that you are able to install the solvers glpk and ipopt. We will likely not have time during the tutorial to work on installation or compilation issues associated with these solvers.

Additional instructions and examples: https://github.com/jckantor/ND-Pyomo-Cookbook