

# Exercises in Computer-Aided Problem Solving

# 1. Introduction to this course

- Instructors and course information
- Purpose of this course
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- Overview of Octave/MATLAB
- Installing GNU Octave to your PC

# Instructors and course information

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## Course information

Computer Vision Lab@Tohoku Univ. (Google “okatani tohoku”)

- Courses
- Exercises in Computer-aided Problem Solving

<http://www.vision.is.tohoku.ac.jp/us/course/computer-aided-problem-solving/>

# Purpose of this course

- Students will learn how a computer can be used to solve mathematical problems.
- Although the course will use Octave for this purpose, its focus is more on mastering mathematical skills rather than learning how to use it.
- Starting with the basic usage of Octave (or MATLAB) and how to write a program on it, students will learn how they can solve various mathematical problems by writing and executing simple programs.
- The course will cover not only mathematics that students have already learned, such as calculus, differential equation, linear algebra, etc., but also those that they have not learned, such as numerical computation, signal processing, statistics, machine learning, etc.
- The goal of this course is to have students master skills of solving the specific problems considered in this course using Octave (or MATLAB) and further obtain a concept of how they can utilize a computer to deal with novel problems.

# Important remarks

- *All students* are required to bring laptop computers to every class.
- Exercise problem(s) will be assigned to students on each class day (not today)
  - The first half of each class day will be spent for explaining problems and their solutions. Students may start to solve exercise problems the rest of the time.
- Students are *required to submit all exercise problems* given on each class day in a week
  - E.g., Exercises on a Monday must be submitted until the next Monday, etc.
  - Submission is done by sending a PDF including scripts and results (e.g., plots) directly to [hirota@dragon.ifs.tohoku.ac.jp](mailto:hirota@dragon.ifs.tohoku.ac.jp) and [j.okajima@tohoku.ac.jp](mailto:j.okajima@tohoku.ac.jp)
- Grading will be based on a *weighted combination* of class participation, assignments.

# Schedule

- |        |  |                               |
|--------|--|-------------------------------|
| 9 Apr  | 1. Introduction and installation of Octave                   |                               |
| 13 Apr | 2. Fundamentals of Octave/MATLAB                             |                               |
| 16 Apr | 3. Matrices and linear algebra I                             |                               |
| 20 Apr | 4. Roots of algebraic and transcendental equations           |                               |
| 23 Apr | 5. Least-square method and line fitting                      |                               |
| 27 Apr | 6. Numerical integration and ordinary differential equations |                               |
| 7 May  | 7. Signal processing   | 30 Apr and 5 May are holidays |
| 11 May | 8. Probability theory: basics                                |                               |
| 14 May | 9. Statistics I  |                               |
| 18 May | 10. Matrices and linear algebra II                           |                               |
| 21 May | 11. Statistics II  |                               |
| 25 May | 12. Machine learning I                                       |                               |
| 28 May | 13. Machine learning II                                      |                               |
| 1 June | 14. (backup for schedule change)                             |                               |
| 4 June | 15. (backup for schedule change)                             |                               |

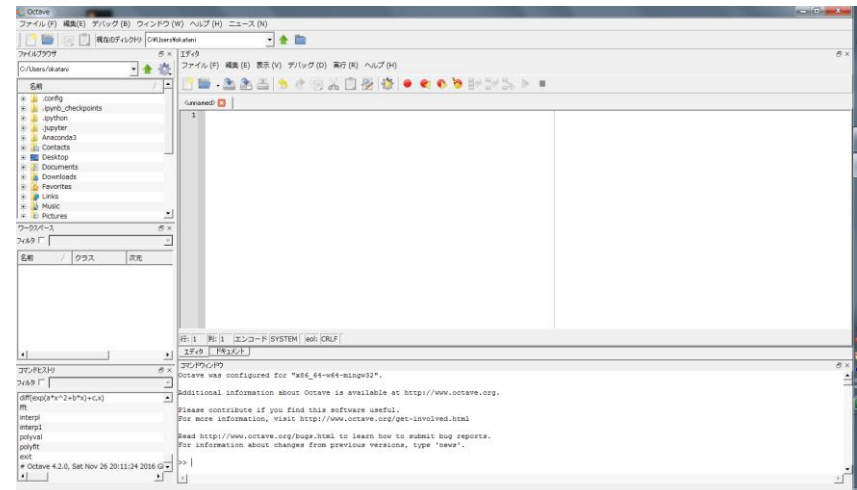
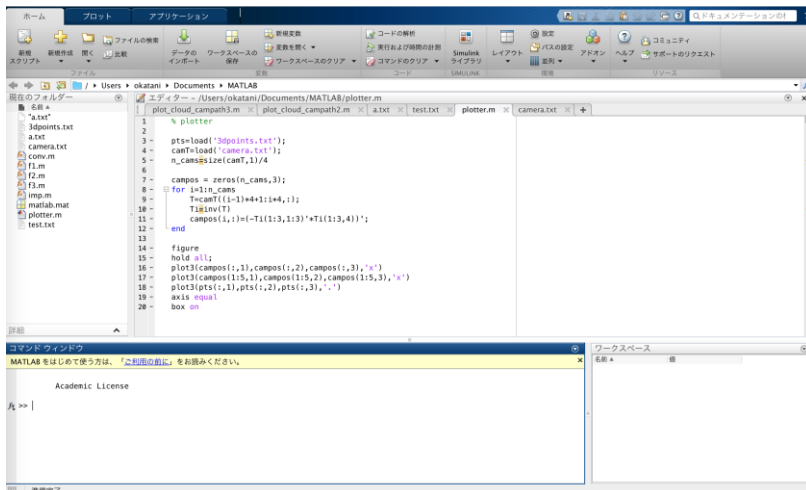
# MATLAB / Octave

## MATLAB

- A numerical computing environment and programming language developed and sold by MathWorks
- *De facto* standard in many scientific/engineering fields the world over
- A wide variety of extensions, called *toolboxes*, are available for use in a diverse field of applications

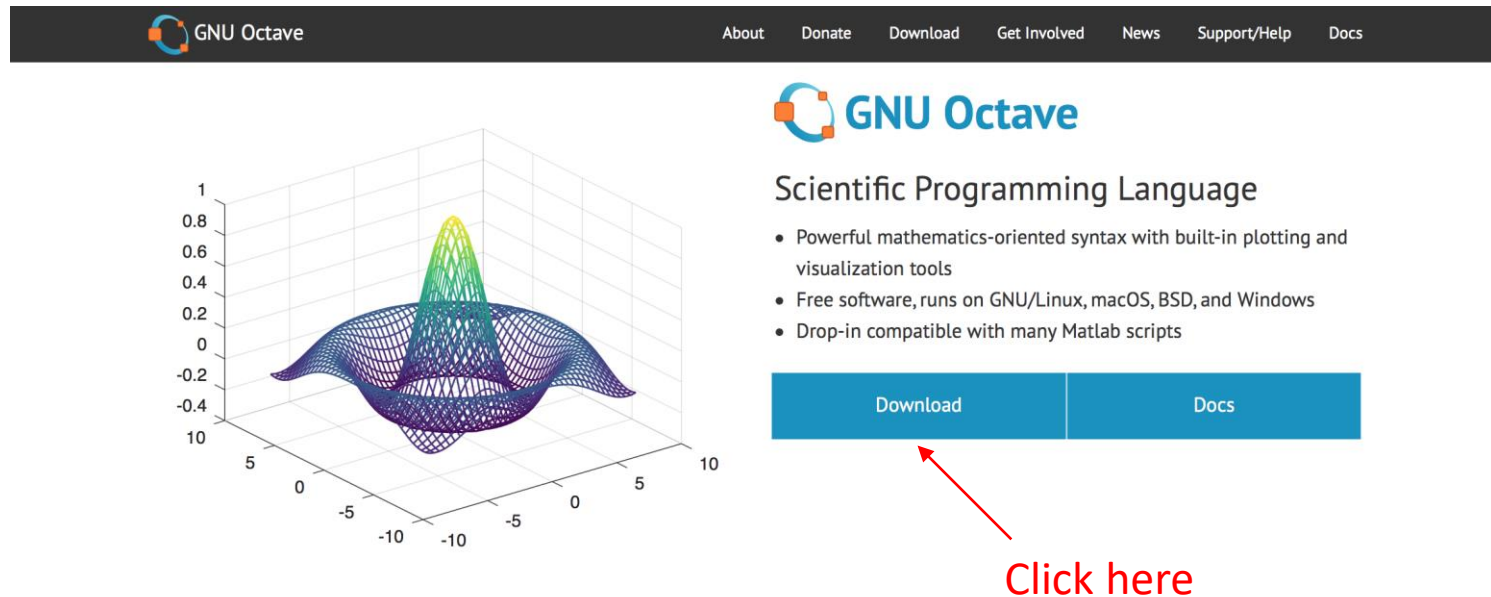
## GNU Octave

- A numerical computing environment and programming language developed by volunteers and can be used for free
- Compatible to MATLAB to a certain degree
- A variety of extensions called *packages*, the counterpart of the toolboxes, is available but has only limited compatibility



# Installing Octave to your PC (1/3)

- To install the Windows version of Octave, follow the procedures below
- Access the following URL with a Web browser and click “Download”
  - <https://www.gnu.org/software/octave/>



GNU Octave

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## GNU Octave

### Scientific Programming Language

- Powerful mathematics-oriented syntax with built-in plotting and visualization tools
- Free software, runs on GNU/Linux, macOS, BSD, and Windows
- Drop-in compatible with many Matlab scripts

Download Docs

Click here

## Syntax Examples

The Octave syntax is largely compatible with Matlab. The Octave interpreter can be run in GUI mode, as a console, or invoked as part of a shell script. More Octave examples can be found in [the wiki](#).

Solve systems of equations with linear algebra operations on **vectors** and **matrices**.

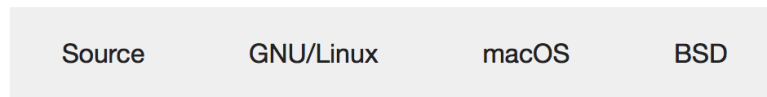
```
b = [4; 9; 2] # Column vector
A = [ 3 4 5;
      1 3 1;
```



# Installing Octave to your PC (2/3)

- Further select “Windows” and click the link then appeared

Install

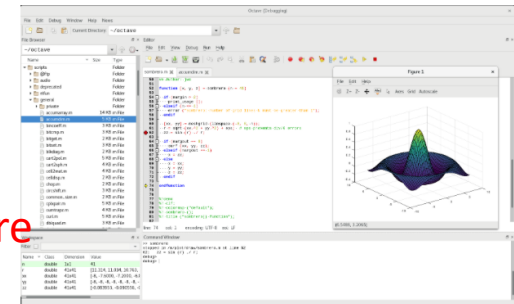


Windows binaries with corresponding source code can be downloaded from  
<https://ftp.gnu.org/gnu/octave/windows/>.











Click here

Windows

Click here

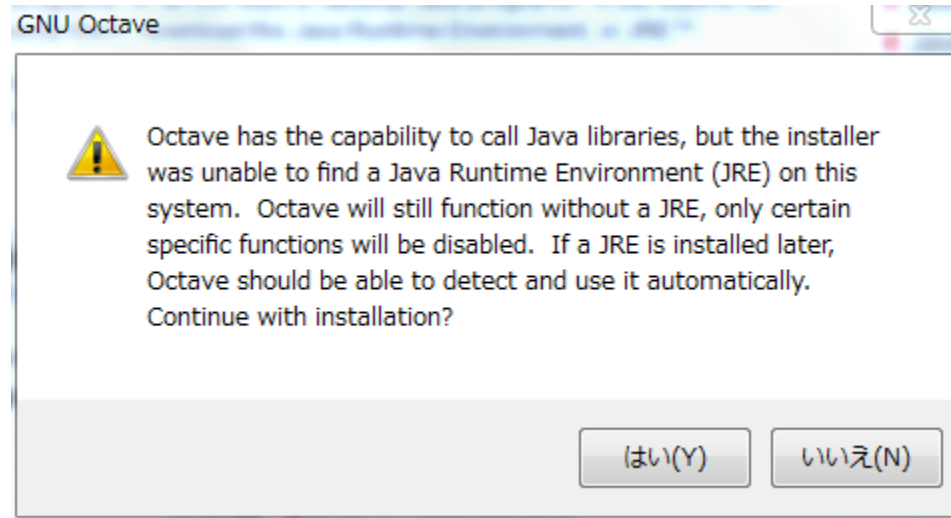


- Select the latest version (octave-4.2.1-wxx-installer.exe)
  - Decide xx part (32 or 64) depending on the OS of your PC

	<a href="#">octave-4.2.0-w64.zip.sig</a>	2016-11-14 10:21	72
	<a href="#">octave-4.2.1-w32-installer.exe</a>	2017-02-24 08:40	170M
	<a href="#">octave-4.2.1-w32-installer.exe.sig</a>	2017-02-24 08:40	95
	<a href="#">octave-4.2.1-w32.zip</a>	2017-02-24 08:46	280M
	<a href="#">octave-4.2.1-w32.zip.sig</a>	2017-02-24 08:46	95
	<a href="#">octave-4.2.1-w64-installer.exe</a>	2017-02-24 08:51	184M
	<a href="#">octave-4.2.1-w64-installer.exe.sig</a>	2017-02-24 08:51	95
	<a href="#">octave-4.2.1-w64.zip</a>	2017-02-24 09:00	378M
	<a href="#">octave-4.2.1-w64.zip.sig</a>	2017-02-24 09:00	95
	<a href="#">source/</a>	2015-06-12 15:35	-

# Installing Octave to your PC (3/3)

- Run the downloaded .exe file by clicking it
  - Neglect the following message about JRE(Java runtime environment) by clicking “Yes” and continuing the installation



- You will have to wait for a few minutes until the completion