CS 105

Introduction to Scientific Computing

Lecture # 1 – Introduction and MATLAB

Matt Burlick
Stevens Institute of Technology

ABOUT ME…

- Matt Burlick
  - Education:
    - BEE University of Delaware
    - MS/PhD in CS Stevens Institute of Technology
      - Focus on Computer Vision
  - Employment
    - Taught HS Math and CS at Holy Family Academy in Bayonne
    - Freelance database driven web programming
  - Interests
    - Playing music and sports

COURSE DESCRIPTION

- This is a first course in computer programming for students with no prior experience.
- Students will learn the core process of programming:
  - Given a problem statement, how does one design an algorithm to solve that particular problem and then implement the algorithm in a computer program?
- The course will also introduce elementary programming concepts like basic control concepts (such as conditional statements and loops) and a few essential data types (e.g., integers and doubles).
- Exposure to programming will be through a self-contained user-friendly programming environment, widely used by the scientific and engineering communities, such as Matlab.
- The course will cover problems from fields of science, engineering, and business.

COURSE OUTCOMES

- Problem Solving
  - Systematically divide a problem into a sequence of steps
- Pseudo-code
  - Produce pseudocode or a diagram to show the algorithm needed to solve a problem
- Coding
  - Convert pseudocode for simple problems to high-level programming language solutions.
- Tracing
  - Be able to trace the execution of a simple Matlab script.

PRIOR EXPERIENCE

- None needed

COURSE CONTACT INFO

- Instructor
  - Matt Burlick
    - Email: mburlick@stevens.edu
    - Office: Lieb 214
    - Office Hours: W 1:00 – 3:00pm
      R 5:00 - 6:00pm
      And by Appointment
- TA
  - Maryam Vatankhah (mvatankh@stevens.edu)
  - Daniel Szymczuk (dszymczu@stevens.edu)
- Graders:
  - John Pesenti (jpesenti@stevens.edu)
  - Sagar Shah (sshah87@stevens.edu)
  - Clara Ramos (cramos1@stevens.edu)
- Canvas!

COURSE CANVAS PAGE

- stevens.edu/canvas (or through mystevens)
  - Even has an iOS/Andriod app!
- Syllabus
- Additional resources
- Slides
- Assignments
- Email
- Discussion Groups/ Forums
- Grades

POLICIES

- Bound by Stevens Honor Code
  - We all are
  - You should discuss with each other *approaches* but not code!
  - Since there is programming, the majority of the work should be your own but if you use existing code YOU MUST CITE IT!!!
    - Otherwise you will receive a zero in addition to other potential consequences.
- Assignments
  - Some combination of programming and textbook problems
  - You can use textbooks, notes
  - You cannot collaborate unless told otherwise
  - Can submit up to 48hrs late
    - 24hrs late → -20%
    - 48hrs late → -50%
    - >48hrs late → -100%
- **Notebook computers/tablets/cellphones etc.. Are NOT to be used in class unless otherwise specified.**
- **Attendance to both Lecture and Lab are MANDETORY (attendance will be taken)**
  - You will be allowed one absence

GRADE BREAKDOWN

- Assignments: 40%
- Attendance: 5%
- Exams (2 @ 15%/exam): 30%
- Final Exam: 25%

- Final grade (including plusses and minuses) are assigned according to class-wide clustering.
- Your grade may be altered based on improvement on later portions of the course.

QUIZZES

- Most weeks there will be a quiz at the beginning of one of the lectures
- The purpose of this is to
  - Ensure attendance
  - See how the prior concepts were understood before the test comes
- They will not be graded, but will count towards your attendance grade

COURSE RESOURCES

- Textbook
  - Stephen J. Chapman , *Essentials of MATLAB Programming, Second Edition* , Cengage Learning, 2009, ISBN 978-0-49529568-6
- Software
  - Matlab

WHAT IS COMPUTER SCIENCE?

- Misconceptions:
  - The study of computers
  - How to write programs
  - How to use software/programs
- Definition:
  - Computer science is the study of algorithms, in particular
    - Their mathematical properties (how long, under what conditions, …)
    - Their hardware realizations
    - Their applications

COMPUTER PROGRAMMING VS COMPUTER SCIENCE

- Computer Programming
  - The tools!

- Computer Science
  - The theory!

WHERE DOES THIS COURSE FIT IN?

- Introduction to Scientific Computing
- Trying to give you tools that you can use in your other classes
  - Fancy calculator
  - Visualize data
  - Analyze data
  - Manipulate data

PROBLEMS WE'LL LOOK AT

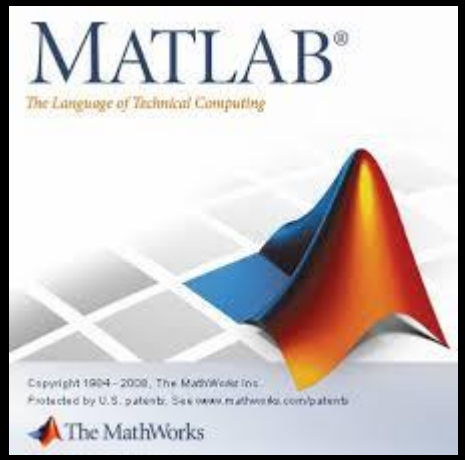
- Business
  - Plot supply and demand curves
  - Determine how long to double your investment
- Math
  - General plotting of equations
- Science
  - Evaluate and plot equations
- Art
  - Image manipulation
- Music
  - Audio manipulation

PROGRAMMING LANGUAGES

- There are so many programming languages
  - Java
  - C++
  - C
  - MATLAB
  - Python
  - Php
- We'll use MATLAB since it's used a lot in scientific communities!

WHAT IS MATLAB?

- MATrix LABoratory
  - Used in scientific communities a lot for it's ease of use (lots of built-in stuff).
  - Built on C with a Java interface.
  - Slow ☹

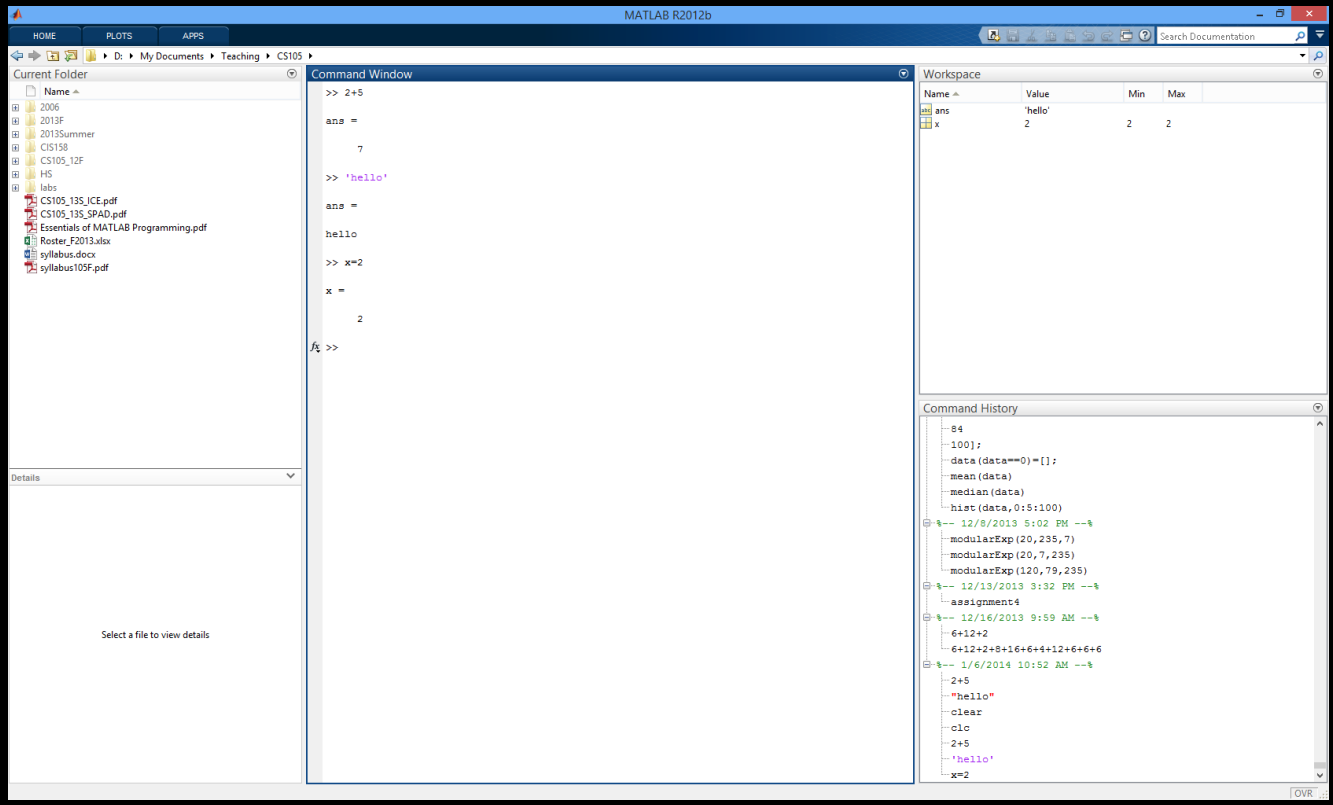


USES OF MATLAB

- Calculator/Scratch Pad
- Plotting
- Running small programs (scripts)
- Creating re-usable code (functions)

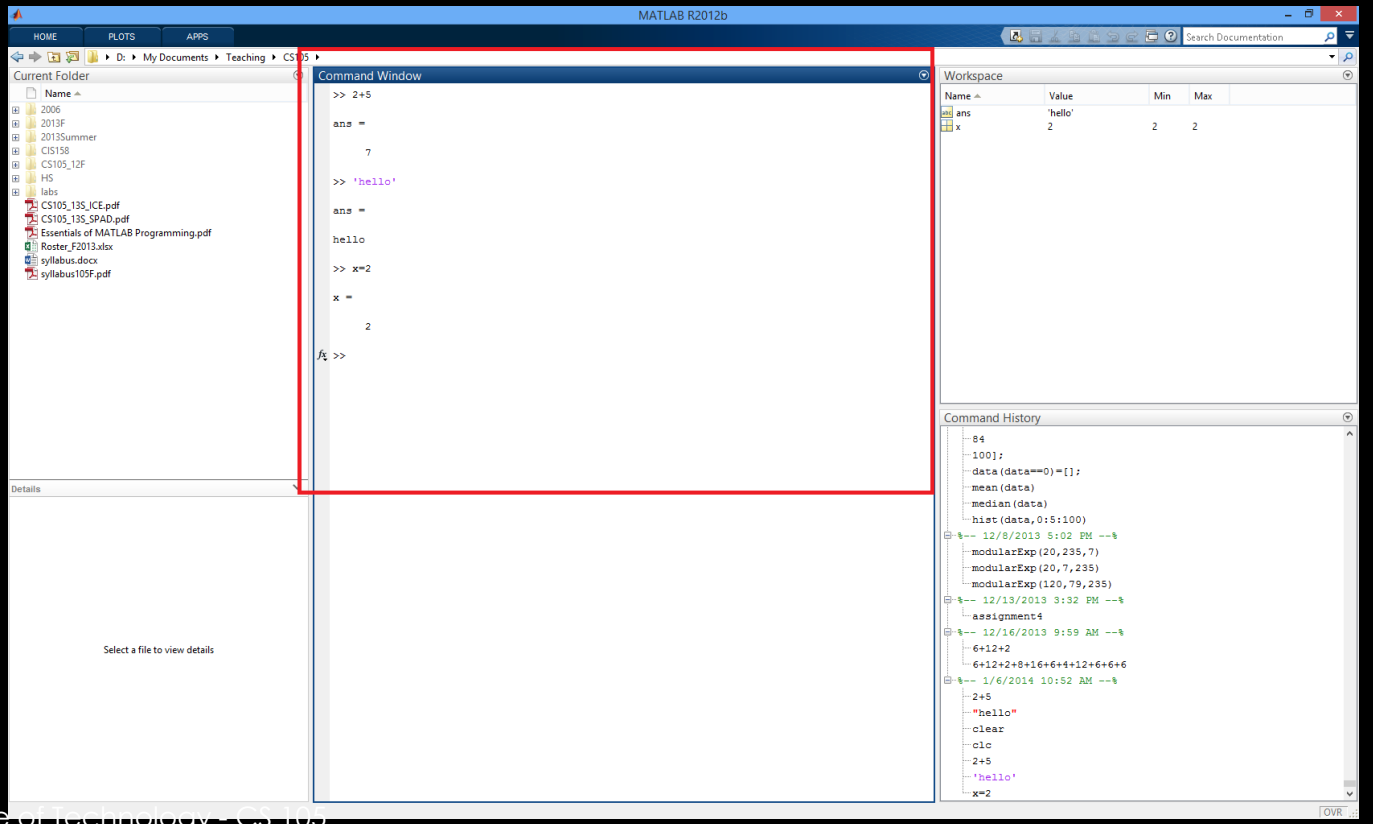
THE MATLAB INTERFACE

- Command Line
- Workspace (variable list)
- Command History
- Directory Browser



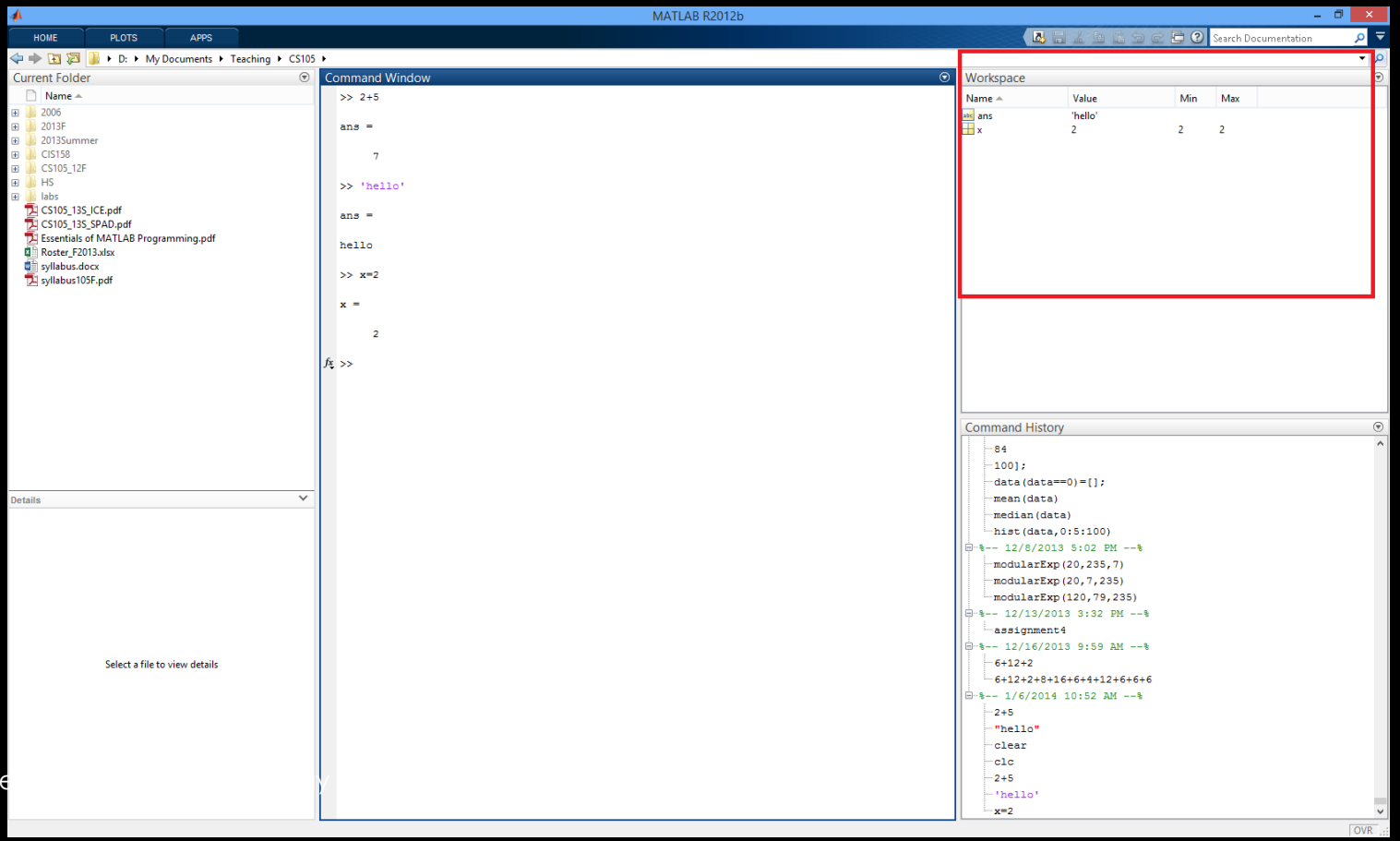
COMMAND LINE INTERFACE

- Here's where we can type single commands one at a time.



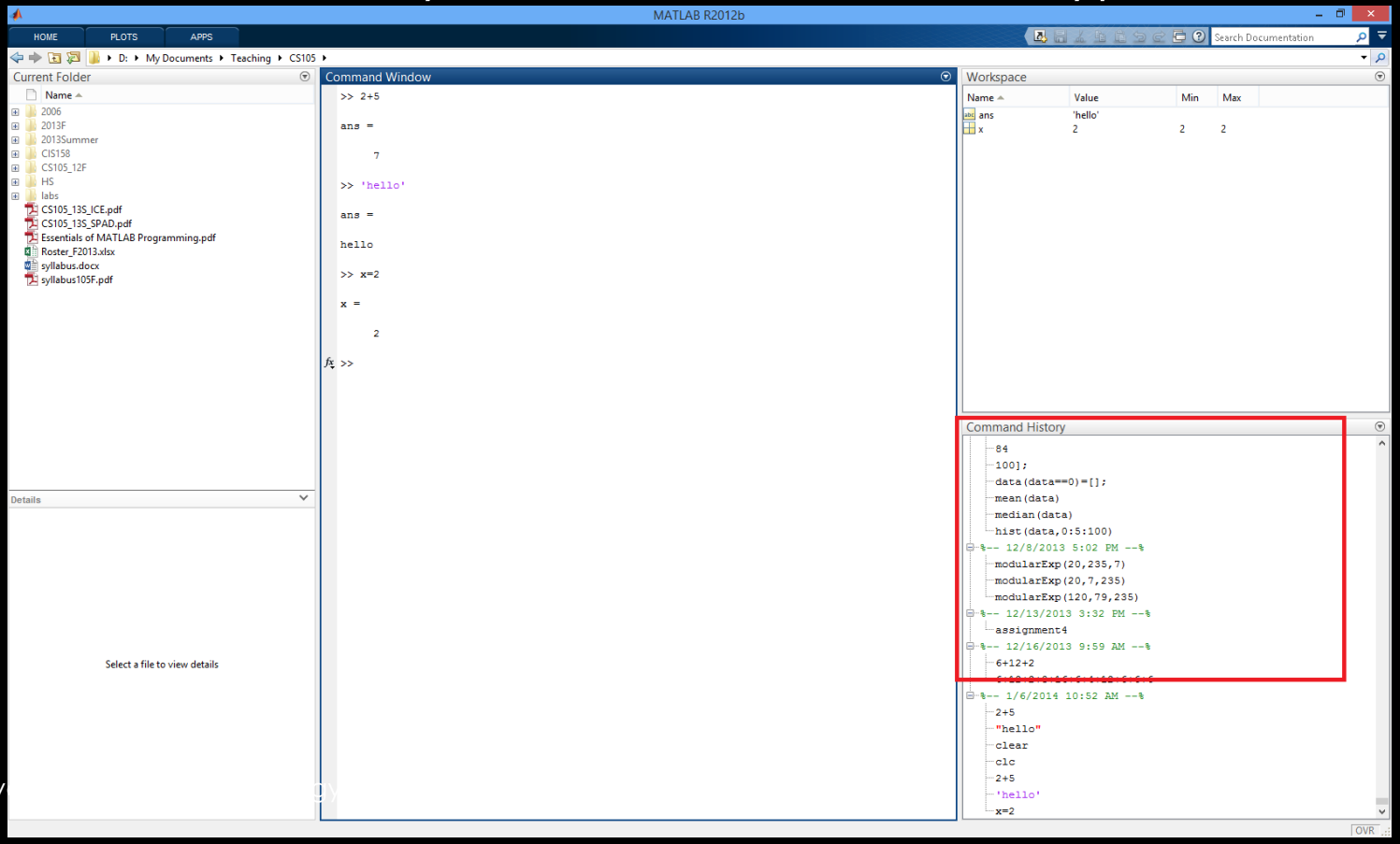
WORKSPACE

- Here's a list of our current variables



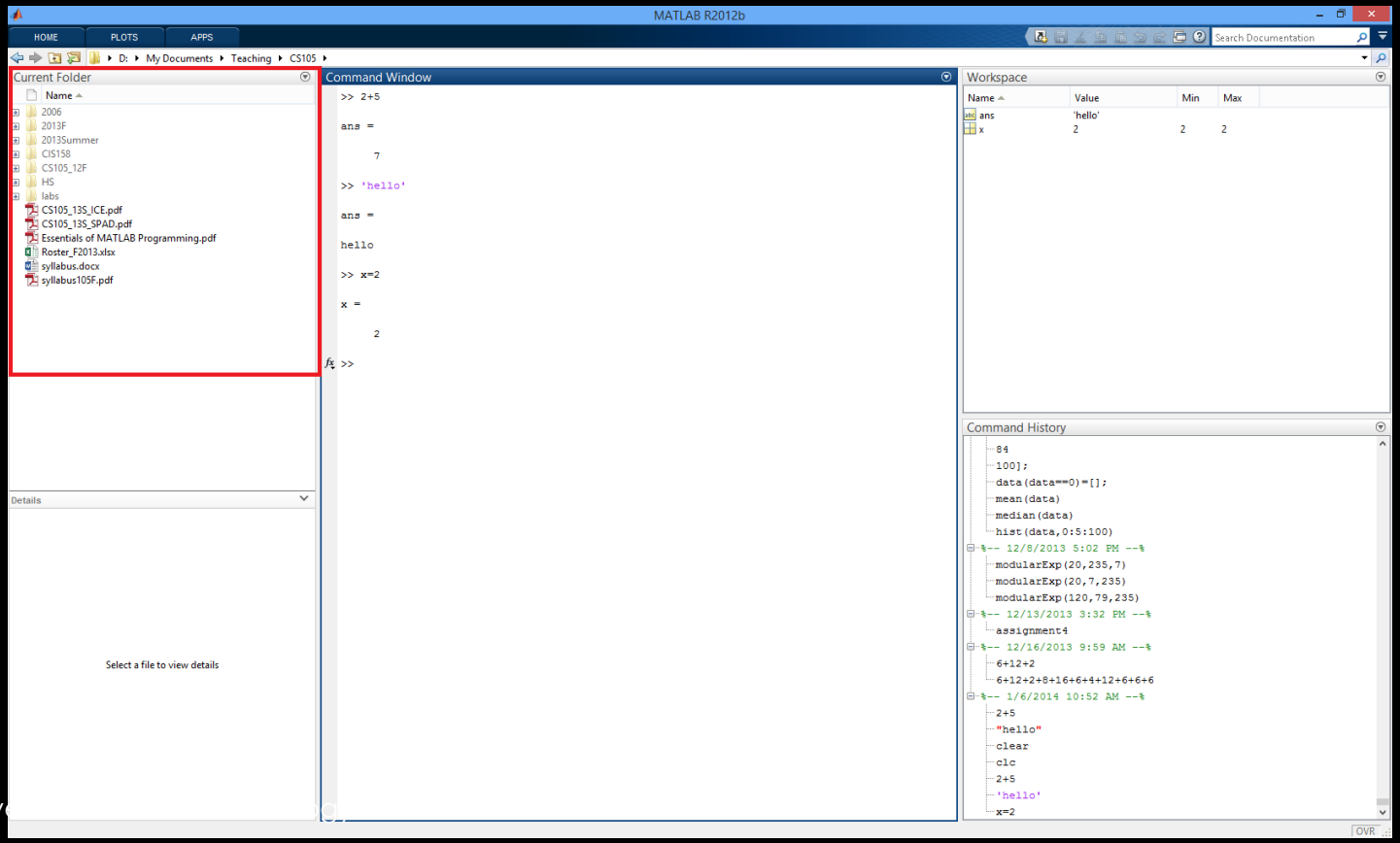
COMMAND HISTORY

- Here's the history of the commands we typed



CURRENT FOLDER

- Here's a list of the files currently available to us



READING

- For more on the Matlab Environment check out the textbook
  - Section 1.3

MATLAB INSTALLATION

- Instructions on the Canvas page
- Windows machines should have it pre-installed
  - Other OS may need to download it from \\storage01\public
- Activation Key is in the instructions