CSE 1570
Introduction to Computing for Psychology

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http://www.cse.yorku.ca/course/1570

Outline

- Course Information
  - Course content
  - Why study the materials?
  - Course objective
  - Textbooks
  - Prerequisite
  - Class format and Marking scheme
  - Course web site and policies
- How to access MATLAB
- Brief introduction to computer and programming language

Course Content

MATLAB

- Powerful computer programming language
- User-friendly programming environment
- Good at
  - Math computation
  - Data analysis and modeling
  - Visualization and graphics
  - Simulation
  - …

Psychtoolbox (if time and tech support allow**)**

- A collection of programs that facilitate the use of MATLAB for psychological experiments

MATLAB

Short for MATrix LABoratory

Commercial product of *The MathWorks*

Originally designed for solving ***linear algebra*** problems using ***matrices***

Has since been expanded and now has built-in functions for

- data analysis, signal processing, optimization, and other types of scientific computations.
- data visualization
  - Contains functions for 2-D and 3-D graphics and animation.

Why Study MATLAB?

Useful for designing psychology experiments. Allows:

- Stimulus generation
- Response collection
- Data analysis
- Data plotting

It is a general programming language

- Allows you to design creative experiments
- Specialized software, such as *ePrime* and *Psyscope*, may not allow you to implement unconventional experiment designs

Has become popular among experimental psychologists

Why Study MATLAB?

Easy to use, and powerful

- No need to declare the data type of a variable before using it (unlike Java, C, C++, Visual Basic)
- A very rich set of powerful ***built-in functions*** makes complex problems easy to solve
- High-level commands can realize things that would take many lines of program to realize in other languages
- User interface is friendly
  - Comprehensive help facility
  - Use interactively or as programming language

Built-in Function Example

Task: find the roots of a polynomial

- Polynomial: $f(x)=4x^2+10x-8$
- A root of f(x) is a value of x for which f(x)=0

Code of MATLAB:

```
roots([4 10 -8])
```

which will generate:

```
ans =

   -3.1375
    0.6375
```


Course Objective

By the end of the course, you are expected to

- Use the MATLAB environment for fast calculation, data generation, data plotting and analysis.
- Know the basic concepts of computer programming
- Write modest-sized programs in MATLAB
- Implement programs for simple psychological experiments:
  - presenting stimuli
  - gathering response

Text and Reference books

Optional textbook:

- Mauro Borgo, Alessandro Soranzo and Massimo Grassi, ***MATLAB for Psychologists***, Springer, 2012.

Reference book:

- Amos Gilat, ***MATLAB: An Introduction with Applications***, 3rd/4th Edition, Wiley, 2007/2011.

Online materials

- See "*Resources*" on course web site

Topics

Interacting with MATLAB

Variables and mathematical operations

Vectors and matrices

Control structures of program (selection, iteration, etc)

File I/O, recording user responses, etc

Functions

Data types: cell and structure

Plotting

- Creating 2-D and 3-D graphics
- Simple animation

Psychtoolbox (if time and tech support allow)

Math Concepts Used

Basic linear algebra operations

- Matrix addition, subtraction, multiplication, transpose.

Basic knowledge on

- Trigonometric and exponential functions
- Discrete math (factorial, permutation, primes)

Basic statistics and data analysis concepts

- mean, median, standard deviation, variance correlation coefficients, histogram, t-test, etc.
- interpolation and regression

Course Prerequisite

MATH 1505 6.0 (Mathematics for Life and Social Sciences)

Class Format

The first class is held in
- lecture room: **TEL 0014**

Starting from the second class, the lectures will be held in
- AP Labs (**TEL 2027&2032**)
- Will do both lecture and lab exercises.

Marking Scheme

- Assignments (25%)
  - 5 assignments
- Midterm (30%)
  - Tentative time: February 28 or March 5 class time
- Final (45%)
  - TBA

Course Web Site

http://www.cse.yorku.ca/course/1570

You can find:
- Lecture notes (will be posted right before each lecture)
- Assignments (when available)
- Links to online resources
- Information on how to access MATLAB
- Course policies
- FAQs
- …

Policies

See the course web site for policies on
- How to submit an assignment
- Academic dishonesty
- What if fail to submit an assignment or fail to attend tests

Instructor and TAs

Instructor: Aijun An
- Email: aan@cse.yorku.ca
- Office: LAS 2048
- Office Hour: Tue & Thu 1:15pm-2:15pm

Teaching Assistants
- Jessie Zhao (jessie@cse.yorku.ca)
- Mehdi Kargar (kargar@cse.yorku.ca)

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How to Access to MATLAB

Use MATLAB **on Campus**

- CSE Undergraduate Lab (LAS 1002)
  - You need a ***PRISM Lab account*** to use the machines in this lab.
- AP Labs (TEL 2114, 2116, 2118, 2027, 2132)
  - You need a ***Passport York account***
- Computing Commons Labs (WSC, ACE 017)
  - You need a ***Passport York account***
- On a computer in the above labs, you can invoke MATLAB by choosing start → program → MATLAB →R2010a →MATLAB R2010a

How to Access MATLAB

Use MATLAB **at Home**

- Through York's WebFAS
  1. Go to WebFAS main page:
     - http://webfas.yorku.ca
  2. Click on Connect to WebFAS in the middle of the page.
  3. Login with ***your Passport York*** username and password
  4. A list of applications appears on your browser
  5. Click on "Matlab R2010a" to launch MATLAB
- If it is your first time to log into WebFAS from your remote computer,
  - after step 3, you will be prompted to install a client (Citrix Receiver)
  - Follow the on-screen instructions to complete the installation.

Computer Accounts Needed

You need to have the following two computer accounts:

- CSE PRISM Lab account
- Passport York account

Why Need a Prism Lab Account

You need a ***CSE PRISM Lab account*** to

- User the computers in LAS 1002
- Download CSE1570 lecture notes and assignments from the course web site
- Submit your assignments online
- Check your marks online

How to Create a Prism Lab Account

Prism Lab Account Activation

- You have to be registered for a CSE15xx course
- Go to https://webapp.cse.yorku.ca/activ8/
- Follow the on-screen instructions

Information about PRISM Lab

- Lab schedule, account activation, etc.:
- http://www.cse.yorku.ca/glade/

Why Need a Passport York Account

You need a Passport York account to

- Use the computers in AP Labs and Computing Commons
- Use WebFAS service (to use MATLAB at home)

How to Create a Passport York Account

All York students are entitled a Passport York account

Information about Passport York

- http://computing.yorku.ca/students/home/passwords-passport-york-access/

Passport York Account Activation (if you haven't done so)

- Go to the page above
- See the instruction under "How to I get it?"

Free MATLAB Alternative

Octave

- Download at *http://www.octave.org*
- A language mostly compatible with Matlab
- Command line interface

Xoctave

- Download at *http://xoctave.webs.com*
- A GUI interface on top of Octave

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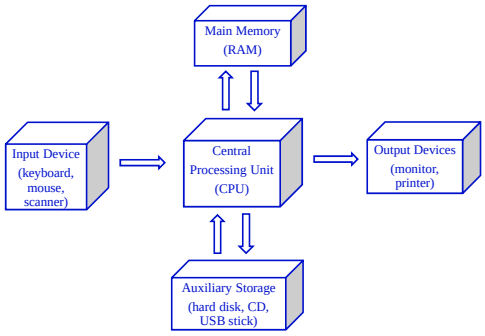
Computer Systems

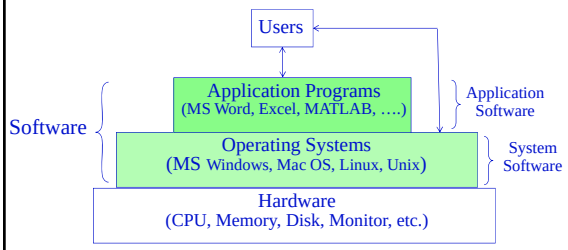
A computer system contains

- Hardware
  - the collection of physical elements that comprise a computer system
  - Examples: processor, main memory, disk, screen, keyboard, etc.
- Software
  - The collection of programs used by a computer system
  - A computer program is
    - a set of instructions for a computer to follow
  - Examples: text editors, operating systems, etc.

Computer Hardware Architecture



Computer Software Structure



Computer Program

A sequence of instructions written to perform a specified task for a computer

Two forms of a program:

- Executable program
  - Binary code (consists of 0s and 1s).
  - Can be directly executed by the computer
- Source code
  - Written in a *programming language* (human understandable)
  - Need to be either converted into an executable program by a *compiler* or may be executed with the aid of an *interpreter*.

Programming Language

An artificial language designed to write computer programs

Can be classified along multiple axes:

- Compiled or interpreted
  - Programs written in a *compiled* language need to be compiled into an executable form by a *compiler* and later executed.
    - The executable program runs faster.
    - Example: C, C++, Fortran
  - Programs written in an *interpreted* language can be executed immediately with the aid of an *interpreter*
    - Program runs slower
    - Example: Perl, MATLAB

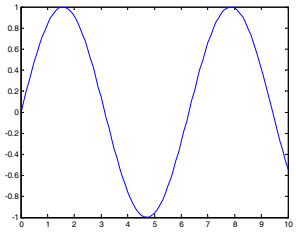
Programming Language (cont'd)

- Procedural or object-oriented
  - Procedural:
    - Program consists of a set of functions or procedures
    - Example: C, Visual Basic, MATLAB, ….
  - Object-oriented:
    - Program consists of classes and objects
    - Example: Java, C++, Python, ….

MATLAB is an interpreted, procedural programming language.

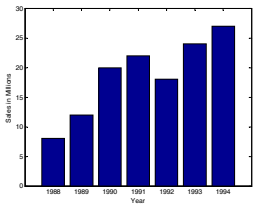
Sample MATLAB Program

```
x=0:0.1:10;
y=sin(x);
plot(x,y)
```



Sample MATLAB Program

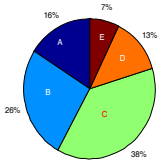
```
year=[1988:1994];
sales=[8 12 20 22 18 24 27]
bar(year, sales)
xlabel('Year')
ylabel('Sales in Millions')
```



Sample MATLAB Program (Generating Pie Plots)

Grade	A	B	C	D	E
Number of students	11	18	26	9	5

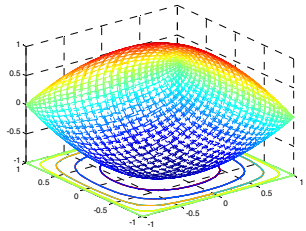
```
grd=[11 18 26 9 5];
pie(grd)
```



The letters (grades) were added using the Plot Editor.

Sample Matlab Programs

```
t=0:0.1:10;
x=sin(t);
y=cos(t);
z=x'*y;
meshc(x,y,z);
```



Things to Do before Next Class

Activate your PRISM lab account

Activate your Passport York account (if you haven't)

Launch MATLAB from a computer on campus

Launch MATLAB from home computer or labtop via WebFAS

Next Class

Topic:

- Interacting with MATLAB
- Variables
- Basic math functions

Location: TEL 2027&2032