AE 102: Data Analysis and Interpretation

January - April 2016

Department of Aerospace Engineering

Recap

- Data analysis:
  - Visualization
  - Inference
  - Modeling
  - Prediction

Recap: terminology

- Observational study
- Outcome
- Treatment
- Association
- Causality
- Causal association

Recap: terminology

- Comparison
- Treatment group
- Control group
- Confounding factor
- Controlled experiment
- Natural experiment

Recap: terminology

- Randomization
- Randomized Controlled Trial
- Placebo
- Blind
- Double blind

Grading

- 40% of top mark is fail
- Extra tutorial sessions for weak students
- 30% assignments
- 10% Q1
- 10% Q2
- 20% MS
- 30% ES

Resources

- Reference text book:

  Introduction to Probability and Statistics for Engineers and Scientists Sheldon M. Ross, Academic Press.

- Gentle reading:

  The Cartoon guide to statistics by Larry Gonick and Woollcott Smith

Plan of Action

- Self-learn chapters 1-3 from the textbook
- Mini-quiz on Thursday 7th.
- Quiz 1 on 18th Jan.
- Meanwhile we learn to use Python for data analysis

Python!

What is Python?

- Powerful
- Easy to learn programming language
- Huge number of libraries
- Scientific computing libraries
- Data science libraries

More about the language

- Created by Guido van Rossum in 1991
- Interpreted
- Used all over the world
- Very popular
- Top scripting language

Let's get started

- First learn some basic Python fundamentals
- Gradually look at more advanced contents
- **Type along!**

Python absolute basics

- The command *python* is your interpreter
- Start *python* and exit:

```
$ python

>>> print("hello world")
hello world
>>> Ctrl-D
```

- Linux and OS X, Ctrl-D will quit.
- Windows:

```
>>> quit()
```

Using Python as a calculator

```
$ python

>>> 1+1
2
>>> 2*3
6
>>> 2 * 3
6
>>> 2 ** 3
8
>>> 2 * * 3
File "<stdin>", line 1
 2 * * 3
SyntaxError: invalid syntax
```

Writing a script

- Write Python code in a file (`hello.py`):

```
print("hello world")
```

- Then run it:

```
$ python hello.py
hello world
```

Add some calculations

- Edit `hello.py`

```
1+1
print("hello world")
2*3
```

- Save it and run it

- So why did it not print 2 and 6??

More arithmetic

```
>>> 2/3
0
>>> 2.0/3
0.666666666666
>>> 3 - 2
1
>>> 7%2
1
>>> 1 * 2 * 3 * ((4+ 5)/6. )**(7+8)
2627.3633422851562
```

Assignments and names

```
>>> a = 1
>>> b = 2
>>> a + b
3
>>> c = a+b
>>> c
3
>>> a = 100.0
>>> c
?
```

Some formal terminology

- Expressions
- Assignment expression
- Names and objects
- Types

Introducing IPython

- A more powerful interpreter
- Tab-completion
- History
- Help
- Much much more

```
$ ipython
```

- If IPython is not installed

```
$ jupyter console
```

The IPython notebook

- Introduction to features
- Starting up:

```
$ ipython notebook
```

- If you have jupyter instead:

```
$ jupyter notebook
```