

PHYS7331 Fall 2017 Network Science Data: Syllabus

Course Description and Objectives:

The class is an introductory course on programming for Network and Data Scientists. In this course, students will learn the fundamentals of computer programming (e.g. control structures, data structures, algorithms, ..) with particular focus on applications to Network and Data Science. For example, the students will learn how to create a network and analyze its basic features using Python. The programming language used in this course is Python 3.6.x.

Co-Prerequisites:

PHYS5116; otherwise please contact the instructors before enrolling to the class.

Programming experience is not required. Instructors will provide extra tutorials if necessary.

Topics Overview:

- I. Basics of computer programming and Python basics (strings, lists, dictionaries, numbers, control-flow statements)
- II. Network data structures (e.g. adjacency matrices, edge lists, adjacency lists, ..)
- III. Introduction to Algorithms (e.g. breadth-search first, depth-first search, ..)
- IV. Data analysis and Visualization in Python (e.g. pandas, matplotlib, seaborn, ..)
- V. Advanced Python (e.g. web scraping and APIs, functional programming, object-oriented programming, code optimization, cython, map-reduce, ..)

Instructors:

Dr. Matteo Chinazzi, m.chinazzi@northeastern.edu

Office hours: Wednesday 2pm-3pm or by appointment.

Location (off campus): 10th floor, 177 Huntington Avenue, Boston, MA 02115, USA

Dr. Qian Zhang, qi.zhang@northeastern.edu

Office hours: by appointment.

Location (off campus): 10th floor, 177 Huntington Avenue, Boston, MA 02115, USA

Logistics:

Date range: Sep 6, 2017 to Dec 16, 2017

Time: 5pm-7:10pm

Days: Tuesday and Thursday

Venue: TBD

Class Materials, Announcements, and Communications:

All the materials, announcements, assignments will be posted on Piazza (<https://piazza.com/northeastern/fall2017/phys7331/>).

(Optional) Textbooks:

There is no required textbook for this class. Instructors will provide the required reading materials but the following textbooks/online materials are recommended:

1. **Python Data Science Handbook, Jake VanderPlas**, <https://github.com/jakevdp/PythonDataScienceHandbook>
2. **Google's Python class**, <https://developers.google.com/edu/python/>
3. **Scipy-Lectures**, <http://www.scipy-lectures.org/>
4. **Network Science**, Barabasi, <http://barabasilab.com/networksciencebook/>

Coursework:

- I. Take home exercises: 20%
- II. In class exercises and participation: 20%
- III. Midterms coding exams : 30%
- IV. Final coding exam: 30%

Coding exams:

- Students are going to implement - from scratch - some of the concepts outlined in class using Python programming language (version 3.6.x).
- Instructions on how to submit the assignments is going to be provided in class.

Academic Integrity:

The university views academic dishonesty as one of the most serious offenses that a student can commit while in graduate school and imposes appropriate sanctions on violations. Cheating on homework will not be tolerated. Please visit <http://www.northeastern.edu/osccr/academic-integrity-policy/> for more information.

PHYS7331 Fall 2017 Tentative Schedule

| WEEK | Tuesday | Thursday | Friday |
|------------|--|---|--------------|
| 9/4/2017 | No Class for Labor Day | Introduction to Python | |
| 9/11/2017 | Advanced Python | NumPy + Network Basics | |
| 9/18/2017 | Numpy + Matplotlib + Network Basics | Numpy + Matplotlib + Scipy + Network Basics | HW1 Released |
| 9/25/2017 | Fetching Data from the Web: HTML Parsing | Fetching Data from the Web: API theory | HW1 Deadline |
| 10/2/2017 | Fetching Data from the Web: Twitter API | Basic Python Wrap up/Exercise/Midterm 1 | HW2 Released |
| 10/9/2017 | Introduction to OOP | Data Structure: Tree | HW2 Deadline |
| 10/16/2017 | Data structure: Graph | Algorithm: Introduction | HW3 Released |
| 10/23/2017 | Algorithm: DP | Algorithm: Greedy | HW3 Deadline |
| 10/30/2017 | Algorithm: Graph Search | Algorithm: Shortest-path I | |
| 11/6/2017 | Algorithm: Shortest-path II | Algorithm: MST | HW4 Released |
| 11/13/2017 | Algorithm: Binary Search Tree | Algorithm: Hash Tables | HW4 Deadline |
| 11/20/2017 | Algorithm Wrap up/Exercise/Midterm 2 | No Class for Thanksgiving | |
| 11/27/2017 | Introduction to Cloud Computing | DB: SQL and BigQuery | |
| 12/4/2017 | TBA | TBA | |
| 12/11/2017 | Final Exam | Final Exam | |