Course Description and Objectives:
The class is an interdisciplinary course focusing on practical exercises in real network data. In this class, students will learn how to retrieve network data from the real world, analyze network structures and properties, study dynamical processes on top of the networks, and visualize networks. The main programming used in this course is Python 3.6.x.

Prerequisites:
PHYS5116 or equivalent (e.g. CS7785); PHYS7331 or equivalent (e.g. CS5800, CS7800); otherwise please contact the instructors before enrolling to the class. Python programming experience is required. Instructors will provide extra tutorials if necessary.

Topics Overview:
I. Statistical, structural and content analysis of network data
II. Centrality Measures
III. Network Sampling and Network Filtering
IV. Dynamics on Networks
V. Temporal Networks
VI. Community Detection
VII. Network Visualization
VIII. Advanced topics (e.g. multiplex networks, big data network analysis, ..)

Instructors:
Dr. Matteo Chinazzi, m.chinazzi@northeastern.edu
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Location (off campus): 10th floor, 177 Huntington Avenue, Boston, MA 02115, USA

Dr. Qian Zhang, qi.zhang@northeastern.edu
Office hours: by appointment.
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Logistics:
Date range: Jan 8, 2018 to April 27, 2018
Time: 5pm-7:10pm
Days: Monday and Wednesday
Venue: Forsyth Building 238
Class Materials, Announcements, and Communications:
All the materials, announcements, assignments will be posted on Piazza (https://piazza.com/northeastern/spring2018/phys7332/).

(Optional) Textbooks:
There is no required textbook for this class. Instructors will provide the required reading materials but the following textbooks are recommended:

Coursework:
I. In-class exercises and participation: 20%
II. In-class quizzes: 20%
III. Class project, project milestones, final presentation, and project report: 40%
IV. Final in-class exam: 20%

Class project:
➔ Students are going to study a network dataset of their choice by implementing - from scratch - some of the concepts outlined in class using Python programming language (version 3.6.x).
➔ Project milestones are going to be scheduled during the duration of the class (details will be provided in class)
➔ Students are expected to provide all the codes used and to prepare a final report about their project.
➔ An oral presentation might be required.

Project milestones:
- 0) Collect timestamped network data either via web scraping or APIs
- 1) Perform a basic analysis of your network (degree distribution, clustering, assortativity, etc..)
- 2) Look at centralities in your network
- 3) Network sampling
- 4) Dynamic processes on your network
- 5) Graph partitioning and community detection
- 6) Time-varying network analysis

In-class quizzes:
Students are going to take in-class quizzes covering the materials of the previous classes and they might be required to provide not only theoretical answers but also pseudo-code implementations of the algorithms explained 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.
Tentative schedule:

<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATE</th>
<th>LECTURE</th>
<th>TOPIC</th>
<th>DATE</th>
<th>LECTURE</th>
<th>TOPIC</th>
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<td>1</td>
<td>1/8/2016</td>
<td>1</td>
<td>Intro to Class / Reviewing Basic Concepts I</td>
<td>1/10/2016</td>
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<td>1/17/2016</td>
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