CP 101 Introduction to Urban Data Analytics (4 credits)
Lecture: Mon/Wed 12:30 pm–2:00 pm; Wurster 112
Labs: (1) Wed 2:00–3:30 pm, (2) Wed 3:30–5:00 pm; Wurster 214C

Course Description
This course (1) provides a basic intro to census and economic data collection, processing, and analysis; (2) surveys, modeling, and story mapping techniques in planning; (3) demonstrates the uses of real-time urban data and analytics; and (4) provides a socio-economic-political context for the smart cities movement, focusing on data ethics and governance.

Synopsis
CP 101 introduces students to the systematic analysis of urban data in its institutional context. Recognizing that defining this context relies on critical thinking with regard to economic, social, and environmental outcomes, this course explores how stakeholders conceptualize "smart" urbanity. Accordingly, this course will teach students systematic approaches to collecting, analyzing, modeling, and interpreting quantitative and qualitative data used to inform robust research, and, ultimately, urban planning practice and policymaking. Beyond instruction in urban data science and analytics, students will be introduced to theory and critical discourses on topics such as big data, open data and e-governance. Instructors will expect students to engage with technical and theoretical - with particular focus placed on ethical - considerations associated with these subjects in lecture and laboratory sections. The course will introduce students to programming in Excel and Python, using open source software, accessing open and scraped data, and other tools and techniques for urban analysis.

The course will be structured following 3 modules:

Module 1: Introduction to Data Science for Planners
> During this module students will be introduced to the smart cities construct and associated topics, and will explore fundamental data applications in urban planning. They will be instructed on sourcing data, analyzing data via statistical testing, and presenting data through written reports and visualizations. In Module 1, students will gain skills in working with Census and economic data, statistical testing, and static data visualization. The deliverable for this module will be a descriptive profile of a Bay Area neighborhood.

Module 2: Mapping the City
> In the course's second module, students will learn different tools to make maps. We will gain an understanding of the basic elements of maps, how to map with online programs

and geographic information systems software (ArcGIS), and how to construct story maps. Students will produce a story map as the product for this module.

Module 3: Big Data and Analytics
In the course's final module, students will use knowledge acquired in earlier modules to explore urban data science in the context of smart cities. Classes will cover topics such as big data, open data, and smart cities, and civic hacking; and students will gain skills in real-time and crowd-sourced data collection and use, as well as in interactive data visualization. As the final project for the class, students will use novel sources of data to answer a research question of their choice.

Prerequisites
CP 101 reserves seats for CED majors, as well as others from around campus (e.g., Data Science majors); others can enroll with the permission of the instructor. No prior statistics coursework is assumed. This class provides a foundation to pursue further undergraduate data science courses at UC-Berkeley. For Urban Studies CP 101 satisfies one of the four additional City Planning courses for Upper Division Urban Studies Core. For the City Planning minor, CP 101 satisfies one of the four additional City Planning courses for Upper Division courses under List 1. For SED, CP 101 can count as an Upper Division outside SED major for Fall 16 admits and later. Fall 15 and prior SED admits as well as Sustainable Design minor students can petition for it to fulfill a requirement.

Course Requirements
All computer assignments will involve the use of data and software available in or through the DCRP Computer Lab. We will be holding labs in a CED computer lab - lab computers use Windows' operating system. You may use your personal computer in lab, if you'd like. We'll be teaching labs for both PC and Mac users. If you are unfamiliar with either Windows or DCRP's computer lab and want to use lab computers, you are encouraged to take advantage of the CED's library services (Environmental Design Library Website) or consult with course instructors during office hours.

Students will be expected to have a working knowledge of the Microsoft Office Suite - specifically Excel, PowerPoint, and Word - for this course. Students are welcome to explore the use of free, open software interfaces, such as the R language for statistical computing, the RStudio software package; and the QGIS project; however, please check with the graduate student instructor before using any alternative software. Labs will be offered to introduce students to Excel, American FactFinder & Social Explorer, Carto, WordPress, and Python programming.

Grading & Assignments and Reading
Students will be expected to read a number of articles/chapters/etc. prior to lecture and lab sessions. For ten sessions, students are asked to submit responses online on our class bCourse site. Students will also be expected to attend and actively participate in class and lab.

They will take a midterm exam and complete three group projects, as well as a final presentation. Grades will be assigned as follows:

Assignment 1 (Neighborhood Profile): 20%
Assignment 2 (Story Map): 15%
Assignment 3 (Final Project): 20%
Midterm Exam: 35%
Reading Responses: 5%
Class Participation: 5%

Reading Responses
Students are expected to submit 10 short (200-250 word) responses to the readings online on the course bCourse site. Only the class sessions marked with a * are available for commentaries; these are the sessions with more theoretical or critical readings, rather than technical texts. The responses should not be simple summaries of the readings, but reactions to the concepts and analyses presented. Responses should be posted by midnight the day before class to the bCourses discussion thread for the lecture (e.g., February 24 for February 25 class).

Assignments
All assignments will be conducted by groups of two students (though students may petition the instructor to expand the group to three). In the first two assignments (Neighborhood Profile and Story Map), students will explore the phenomenon of neighborhood change through in-depth analysis of census and economic data, as well as story-mapping. The Neighborhood Profile will be a Word document of 8-10 pages (1.5 spaces), plus appendices. The Story Map will consist of an interactive online map, with significant explanatory text.

For the third assignment, students will explore a research question of their own choosing, using big data and/or open data portals, as well as analysis and visualization techniques learned in class. This deliverable should include both an online project and a narrative of 15-20 pages (1.5 spaces), including references in proper format. Students will submit a one-page description of their research question and approach in the beginning of April and work closely with the instructors to develop a methodological approach. The semester will culminate with short (8-10 minute) presentations of Assignment 3 (during reading week); this presentation is optional and will be for extra credit.

Exam
There will be a comprehensive midterm examination held after the second module to assess student learning of course topics. The exam will consist of two parts: an in-class quiz (definitions and short answers) based on the class readings and lectures, and an in-lab quiz, based on the lab exercises and assignments.

Attendance and Class Participation

Students are expected to attend *every* class lecture and lab section. If for some compelling reason a student must miss a lesson or lab, they should alert the instructor ahead of time and may be asked to provide documentation of excuse after the fact. In addition to attending, students are expected to actively contribute to class discussions and ask questions. Participation will be evaluated by instructors based on a combination of attendance, and observed engagement and participation.

Course Materials
CP 101 has one required books and one optional book. There is no course reader. All readings that are not part of the required book will be posted to the CP 101 bCourses.

Required:
Singleton, Alex, Seth Spielman, and David Folch. 2018. *Urban Analytics*. Thousand Oaks, CA: Sage.

Optional:
Wheelan, Charles. 2013. *Naked Statistics: Stripping the Dread from the Data*. W. W. Norton & Company.

We expect you to purchase the book at the student store, or via an online bookseller.

Lecture slides and other course materials will be posted on the CP 101 bCourses site.

Office Hours

Prof. Karen Chapple (chapple@berkeley.edu): Thurs 11 AM-1 PM, 326B Wurster (sign up via website, www.karenchapple.com)

Abigail Cochran (acochran@berkeley.edu): Mon 2-4 PM, 326B Wurster (sign up via website before 12:00 pm day of, calendly.com/abigailcochran)

GSI Rachel Om (rachel_om@berkeley.edu): Wednesday 3:30 - 5:30 PM, open office hours 3:30 - 4:30 in lab and individual meetings 4:30 - 5:30 pm in 326B Wurster (sign up via website, https://calendly.com/rachelom)

GSI Phoenix Alfaro (phoenixalfaro@berkeley.edu): Open office hours Monday 11:00 am - 12:00 pm, Wurster 222; Individual meetings: Tuesday 11:00 am - 12:00 pm, Wurster 326B (sign up via https://calendly.com/phoenixalfaro)

Statement on Academic Integrity
Any test, paper or report submitted by you and that bears your name is presumed to be your own original work that has not previously been submitted for credit in another course. You may use words or ideas written by other individuals in publications, websites, or other sources, but

only with proper attribution. If you are not clear about the expectations for completing an assignment or taking an exam, be sure to ask a course instructor.

You should also keep in mind that as a member of the campus community you are expected to demonstrate integrity in all of your academic work and be evaluated on your own merits. The consequences of cheating and academic misconduct — including a formal discipline record and possible loss of future opportunities — are not worth the risks.

Statement on Accommodations for Students with Disabilities
If you have been issued a letter of accommodation from the [Disabled Students Program (DSP)](), please see the course lead instructor as soon as possible to work out the necessary arrangements. If you need an accommodation and have not yet seen a Disability Specialist at the DSP, please do so as soon as possible.

If you would need any assistance in the event of an emergency evacuation of the building, the DSP recommends that you make a plan for this in advance. (Contact the DSP access specialist at 643-6456.)

Statement on Scheduling Conflicts
Please notify course instructors by the second week of the term about any known or potential extracurricular conflicts (such as religious observances, graduate or medical school interviews, or team activities). We will try our best to help you with making accommodations, but cannot promise them in all cases.

Course Schedule - Readings & Assignments
The course schedule/readings are outlined below.

Module 1: Introduction to Data Science for Planners

Wednesday, January 23*: Introduction to Urban Analytics

Singleton, Spielman, and Folch (2018) Chapter 1, "Questioning the city through urban analytics"

Kim, Annette. 2018.
https://www.theatlantic.com/technology/archive/2018/06/satellite-images-can-harm-the-poorest-citizens/561920/

Optional:
Hollands, Robert G. 2008. "Will the Real Smart City Please Stand up?: Intelligent, Progressive or Entrepreneurial?" *City* 12 (3): 303–20. doi:10.1080/13604810802479126.

Lab 1 (optional): Introduction to Excel

Monday, January 28: **Data Fundamentals for Planners***

Singleton, Spielman, and Folch (2018) Chapter 2, "Sensing the city"

Boyd, Danah, and Kate Crawford. 2012. "CRITICAL QUESTIONS FOR BIG DATA: Provocations for a Cultural, Technological, and Scholarly Phenomenon." *Information, Communication & Society* 15 (5): 662–79. doi:10.1080/1369118X.2012.678878.

Neruda, Pablo, and Margaret Sayers Peden. 1986. "Ode to Numbers." The Massachusetts Review 27 (3/4): 464–66.

Wheelan (2013) Chapter 7, "The Importance of Data"

Wednesday, January 30: **Metadata: Understanding the US Census**

Jurjevich, J. R., Griffin, A. L., Spielman, S. E., Folch, D. C., Merrick, M., & Nagle, N. N. (2018). Navigating Statistical Uncertainty: How Urban and Regional Planners Understand and Work With American Community Survey (ACS) Data for Guiding Policy. *Journal of the American Planning Association*, *84*(2), 112-126.

Alba, Richard. 2015. "The Myth of a White Minority." The New York Times, June 11. http://www.nytimes.com/2015/06/11/opinion/the-myth-of-a-white-minority.html

U.S. Bureau of the Census, TO. 2009. "A Compass for Using and Understanding American Community Survey Data." [SKIM] https://www.census.gov/content/dam/Census/library/publications/2009/acs/ACSResearch.pdf

Lab 2: American FactFinder

Monday, February 4: **Using Census Data**

Bureau, U. S. Census. 2016. "American FactFinder." http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

"Social Explorer." 2016. http://www.socialexplorer.com/

Wednesday, February 6: **Intro to Statistics for the American Community Survey**

Singleton, Spielman, and Folch (2018) Chapter 6, "Explaining the city"; pgs. 97-108

Wheelan (2013) Chapters 2 & 3, "Descriptive Statistics" and "Descriptive Deception"

Lab 3: Excel Basics and Generating Charts

Monday, February 11: **More on Statistics**

Singleton, Spielman, and Folch (2018) Chapter 6, "Explaining the city"; pgs. 109-120

Wheelan (2013) Chapters 4, 8, & 11, "The Central Limit Theorem", "Correlation", "Regression
      Analysis"

Wednesday, February 13: **Introduction to Economic Data and the Longitudinal
      Household-Employment Data**

Abowd, J. J., Haltiwanger, J., & Lane, J. (2004). Integrated longitudinal employer-employee data
      for the United States. *American Economic Review*, *94*(2), 224-229.

Lab 4: Accessing Census and Economic Data via Social Explorer

Monday, February 18: **NO CLASS!!!**

Wednesday, February 20: **Static Data Visualization**

Few, Stephen. 2012. *Show Me the Numbers: Designing Tables and Graphs to Enlighten*. 2nd
      ed. USA: Analytics Press. [Lots of pictures, quick reading!]

Few (2012) Chapter 3 pg. 39-51 "Differing Roles of Tables and Graphs", Chapter 4 pp. 53-60
      "Fundamental Variations of Tables" Chapter 5 pg. 67-79 "Attributes of Pre-attentive
      Processing & "Applying Visual Attributes to Design", Chapter 6 pg. 101-135 "Graph
      Design Solutions", Chapter 11 pg. 257-270 "Displaying Many Variables at Once",
      Chapter 13 pg. 295-306 "Telling Compelling Stories with Numbers", Appendix A "Table
      and Graph Design at a Glance" pg. 309-310

Tufte, Edward R. 1983. *The Visual Display of Quantitative Information*. Graphics Press. Chapter
      2, "Graphical Integrity".

Optional:
Check out Piktochart for infographics, www.piktochart.com

And the whole Tufte book is great – especially check out Chapter 1, "Graphical Excellence."

Lab 5: Accessing Local Employment-Household Dynamics Data

Monday, February 25: Neighborhood Data and Indicators: The Urban Displacement Project*

Singleton, Spielman, and Folch (2018) Chapter 5, "Differences Within Cities"

Urban Displacement Project, www.urbandisplacement.org [SKIM]

Chapple & Zuk, "Forewarned: The Use of Neighborhood Warning Systems for Gentrification and Displacement,"
https://www.huduser.gov/portal/periodicals/cityscpe/vol18num3/article5.html

Assignment #1 due Wednesday, February 27!

Module 2: Mapping the City

Wednesday, February 27: Spatial Data & GIS Fundamentals

Singleton, Spielman, and Folch (2018) Chapter 4, "Visualizing the city"

Monmonier, Mark. 1996 Chapters 1, 2, 3, 4, and 10 *How to Lie with Maps*. University of Chicago Press.

Additional GIS mapping information: http://www.icsm.gov.au/mapping/overview.html

Lab 6: Carto Part I

Monday, March 4: Accessibility*

Hamraie, Aimi. 2018. "A Smart City Is an Accessible City." The Atlantic. November 6, 2018.
https://www.theatlantic.com/technology/archive/2018/11/city-apps-help-and-hinder-disability/574963/.

Optional:
Check out paratransit.info

Optional, but STRONGLY RECOMMENDED:

"Curb Cuts." 2018. 99% Invisible (blog). Accessed May 23, 2018.
https://99percentinvisible.org/episode/curb-cuts/.

Wednesday, March 6: **Introduction to Story Mapping***

Examples to review:

- Displacement in the Bay Area: www.antievictionmappingproject.net and http://www.antievictionmap.com/#/narratives-of-displacement/
- Mapping Segregation in DC. http://jmt.maps.arcgis.com/apps/MapJournal/?appid=061d0da22587475fb969483653179091
- Somerville Community Map: http://archive.somervillecdc.org/communitymap/
- City of Words DC: http://maps.google.com/gallery/details?id=zfi7hbGPyckg.ktCoxcliDDS0&hl=en
- Gangs of Los Angeles (2015): http://maps.google.com/gallery/details?id=zMC7tfcRop6s.koD9cCcyHJ_0&hl=en
- Atlas for a Changing Planet: http://storymaps.esri.com/stories/2015/atlas-for-a-changing-planet/
- Katrina +10: A Decade of Change in New Orleans:

  http://story.maps.arcgis.com/apps/MapSeries/index.html?appid=597d573e58514bdbbeb53ba2179d2359

You can find more examples at the Google My Maps Gallery:
http://maps.google.com/gallery?hl=en and check out ESRI's gallery for more ideas:
https://storymaps.arcgis.com/en/gallery/#s=0

Lab 7: Carto Part II

Monday, March 11: **Participatory Mapping** *(guest speaker TBD)**

Parker, Brenda. "Constructing Community through Maps? Power and Praxis in Community
Mapping." *Professional Geographer*, 58:4, (2006): 470-484

Norwood, Carla, and Gabriel Cumming. "Making maps that matter: Situating GIS within
community conversations about changing landscapes." *Cartographica: The International Journal for Geographic Information and Geovisualization* 47.1 (2012): 2-17.

Optional:
Ringas, Dimitrios, and Eleni Christopoulou. "Collective city memory: field experience on the
effect of urban computing on community." *Proceedings of the 6th International Conference on Communities and Technologies*. ACM, 2013.

***Wednesday, March 13*: Power, Place and Mapping** (*guest speaker TBD)*

Harley, J. Brian. "Maps, knowledge, and power" (Chapter 8). In Henderson, George and Waterstone, Marvin. *Geographic thought: a praxis perspective*, 1988. 129-148.

Check out the [Street Story](#) Project

Lab 8: OCF/WordPress and Embedding Carto Maps

Assignment #2 due Friday, March 22!

Module 3: Big Data and Analytics

Monday, March 18*: Introduction to Big Data

Foster, Ian, Rayid Ghani, Ron S. Jarmin, Frauke Kreuter, and Julia Lane. 2017. "Introduction." Pp. 1-19 in *Big Data and Social Science: A Practical Guide to Methods and Tools*. Boca Raton, FL: Taylor & Francis Group.

Wednesday, March 20: In-Class Midterm

Lab 9: In-Lab Midterm

Week of March 25-9: NO CLASS, SPRING BREAK!!

Monday, April 1*: Big Data – and Ethics -- for Planners

Schweitzer, Lisa. 2014. "Planning and Social Media: A Case Study of Public Transit and Stigma on Twitter." *Journal of the American Planning Association* 80 (3): 218–38. doi:10.1080/01944363.2014.980439.

Crawford, Kate, and Jason Schultz. 2014. "Big Data and Due Process: Toward a Framework to Redress Predictive Privacy Harms." *BCL* Rev. 55: 93.

Zwitter, A. 2014. "Big Data Ethics." *Big Data & Society* 1 (2). doi:10.1177/2053951714559253.

***Wednesday, April 3: Complex Urban Modeling Part I: Machine Learning** (guest speaker TBD)*

Foster, Ian et al. 2017. "Machine Learning." Pp. 147-186 in *Big Data and Social Science: A Practical Guide to Methods and Tools*. Boca Raton, FL: Taylor & Francis Group.

Reades, J., De Souza, J., & Hubbard, P. (2018). Understanding urban gentrification through machine learning. *Urban Studies*, 0042098018789054..

Lab 10: Python - Intro to Jupyter/Python/Pandas

Monday, April 8: **Volunteered Geographic Information (VGI)***

Jiang, Bin, and Jean-Claude Thill. 2015. "Volunteered Geographic Information: Towards the Establishment of a New Paradigm." *Computers, Environment and Urban Systems*, Special Issue on Volunteered Geographic Information, 53 (September): 1–3. doi:10.1016/j.compenvurbsys.2015.09.011.

Optional:
Boeing, Geoff, and Paul Waddell. 2016. "New Insights into Rental Housing Markets Across the United States: Web Scraping and Analyzing Craigslist Rental Listings." *Journal of Planning Education and Research*.

Wednesday, April 10: **Interactive Visualizations***

Hemmersam, Peter, Nicole Martin, Even Westvang, Jonny Aspen, and Andrew Morrison. 2015. "Exploring Urban Data Visualization and Public Participation in Planning." Journal of Urban Technology 22 (4): 45–64. doi:10.1080/10630732.2015.1073898.

Anderson, Meghan Keaney. 2016. "12 Complex Concepts Made Easier Through Great Data Visualization — ReadThink (by HubSpot)." Medium. June 27. https://readthink.com/12-complex-concepts-made-easier-through-great-data-visualization-c94950277fed#.lqiyxpvba.

Explore additional interactive visualizations here:
http://polygraph.cool/history/
http://goodcitylife.org/chattymaps/index.html
http://hubcab.org/#13.00/40.7219/-73.9484
http://218consultants.com/interactive-suitability-map/ (Look at all 3 interactive maps)
https://ourworldindata.org/a-history-of-global-living-conditions-in-5-charts/
http://www.urban.org/features/vision-equitable-dc
and of course, http://www.urbandisplacement.org!

Optional:

Foster, Ian et al. 2017. "Working with Web Data and APIs." Pp. 23-70 and "Information Visualization." Pp. 243-263 in *Big Data and Social Science: A Practical Guide to Methods and Tools*. Boca Raton, FL: Taylor & Francis Group.

Lab 11: Python - Web Scraping

Monday, April 15: **Open Data & Using Portals** *(guest speaker TBD)**

Lohr, Steve. 2016. "Website Seeks to Make Government Data Easier to Sift Through." *The New York Times*, April 4.
http://www.nytimes.com/2016/04/05/technology/datausa-government-data.html.

Spiker, Steve. 2013. "Oakland and the Search for the Open City." Pp. 105-124 in *Beyond Transparency: Open Data and the Future of Civic Innovation*. San Francisco, CA: Code for America.

Johnson, Jeffrey Alan. 2014. "From Open Data to Information Justice." *Ethics and Information Technology* 16 (4): 263–74. doi:10.1007/s10676-014-9351-8.

Wednesday, April 17: **Presenting Data**

Schwabish, Jonathan. 2017. Chapter 1 "Theory, Planning and Design"; Chapter 4 "The Text Slide"; and Chapter 5 "The Data Visualization Slide"; in *Better Presentations: A Guide for Scholars, Researchers, and Wonks*. New York: Columbia University Press.

Tufte, Edward, R. 2003. *The Cognitive Style of PowerPoint*. Graphics Press.

Doumont, Jean-luc. 2005. "The Cognitive Style of PowerPoint: Slides Are Not All Evil." *ResearchGate* 52 (1): 64–70.

Parker, Ian. May 28, 2001. Absolute Powerpoint: Can a software package edit our thoughts? *The New Yorker*. http://www.newyorker.com/magazine/2001/05/28/absolute-powerpoint

Optional:
Schwabish, Jonathan. 2017. Chapter 2 "Color" in *Better Presentations: A Guide for Scholars, Researchers, and Wonks*. New York: Columbia University Press.

Lab 12: Python - Mapping

Monday, April 22: **Defining Smart Cities in Theory and Practice***

Batty, M. 2016. "How Disruptive Is the Smart Cities Movement?" *Environment and Planning B: Planning and Design* 43 (3): 441–43. doi:10.1177/0265813516645965.

Shelton, Taylor, Matthew Zook, and Alan Wiig. 2015. "The 'Actually Existing Smart City.'" *Cambridge Journal of Regions, Economy and Society* 8 (1): 13–25. doi:10.1093/cjres/rsu026.

Optional:
IBM Smart Cities website, http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/

Wednesday, April 24: Smart Institutions & e-Governance *(guest speaker TBD)**

Noveck, Beth Simone. 2015. *Smart Citizens, Smarter State: The Technologies of Expertise and the Future of Governing*. Harvard University Press.; Chapter 1 & Conclusion, "From Open Government to Smarter Governance", pg. 1 - 43; "Conclusion: The Daedalus Project", pg. 267 - 275

Also look over: https://smartcitizen.me/

Lab 13: Python - Working with Big Data

Monday, April 29: Civic Hacking and Equity *(guest speaker TBD)**

Barns, Sarah. "Mine your data: open data, digital strategies and entrepreneurial governance by code." *Urban Geography* 37.4 (2016): 554-571.

Wednesday, May 1: The Inclusive Smart City*

Singleton, Spielman, and Folch (2018) Chapter 8, pg. 151 "Networks Supporting Human Progress" & Chapter 9, "The Future of Urban Analytics"

Zook, Matthew. 2016. "Crowd-sourcing the Smart City: Using Big Geosocial Media Metrics in Urban Governance." Unpublished paper.

Shelton, Taylor, Ate Poorthuis, and Matthew Zook. "Social media and the city: Rethinking urban socio-spatial inequality using user-generated geographic information." *Landscape and Urban Planning* 142 (2015): 198-211.

Lab 14: Open Help Session

Assignment #3 due Friday, May 10!