


# Course Syllabus

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CS294-84 / ME 290U: Interactive Device Design  
Fall 2017, UC Berkeley. CCN: 46121 (CS294-84); 39874 (ME 290U) (4 units)

This course teaches concepts and skills required to design, prototype, and fabricate interactive devices – that is, physical objects that intelligently respond to user input and enable new types of interactions. The first half of the semester will be dedicated to a survey of relevant techniques in 3D modeling and fabrication; electronics and circuit board design; sensing and actuation for interaction; embedded software development, wired and wireless communication with mobile devices, computers, and networks; and user interface programming. In the second half of the semester, students will propose and carry out a significant design project. We will provide a set of promising project areas with local partners. Alternatively, groups can also come of with their own product ideas. We encourage students to work on projects in [CITRIS focus areas](#) (<http://citriscu.org/core-initiatives/>): health, energy technologies, connected communities, people and robots; PhD students can also explore projects related to their area of research after consultation with us.

Class sessions will alternate between concepts and experiential learning. Classes will be held in 210 [Jacobs Hall](#) (<http://jacobsinstitute.berkeley.edu/make/jacobs-hall/>).

## Enrollment

Because of the hands-on nature of this course, we have a strict capacity limit of 40 students. Enrollment decisions were made on August 20 (you had to have filled out our [entry survey](#) ([https://docs.google.com/forms/d/e/1FAIpQLSeDgStU427By-yUdnScrlOMb5XU8loqpm3PUuOoUubXiWABGw/viewform?usp=ssf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSeDgStU427By-yUdnScrlOMb5XU8loqpm3PUuOoUubXiWABGw/viewform?usp=ssf_link)) by 8/18). You should have received an email notifying you that you have a spot in this class. If you did not get an acceptance email, please do not come to class - we will not have room for you.

You must also come to the first class meeting and sign in or be excused in advance. If we don't see you, we will offer your spot to another student.

## Prerequisites

- Programming experience required:** You will program embedded systems for this course. You should be able to pick up a new language and API (with some help from us). Knowing the equivalent of the CS61A-C series at Berkeley should be sufficient.
- User Interface Design experience very useful:** Your projects will have both software and hardware user interfaces. Some background in user interface design, e.g., INFO290 Tangible Interaction or CS160 User Interface Design is valuable.
- 3D modeling skills very useful, but not required:** You will model and fabricate parts on our FDM machine. If you want to get a head start, learn how to use SolidWorks, but we'll also have a tutorial.
- Some electronics experience useful, but not required:** You will build basic sensing and actuation circuits. The threshold for doing this has decreased rapidly in recent years, but you will be soldering your own electronics. If you have taken the equivalent of EE40 or have built projects Arduino boards before, you'll be fine.

If you have no programming background, you should not take this course. If you do not have experience in at least one of (UI design, 3D modeling, electronics) you should not take this course. You must be comfortable with learning a sizable set of new tools and processes, quickly.

## Course Information

**Instructor:** Bjoern Hartmann

**GSIs:** Rundong 'Kevin' Tian

**Jacobs Hall Design Specialists:** Mary Catherine Richardson, Matt Wolpe, Gary Gin, Chris Parsell, Kent Wilson.

### Office Hours:

**Bjoern:** Thu 3-4pm, 220A Jacobs Hall, starting 9/7.

**Kevin:** Fri 2-3, Invention Lab (141 Sutardja Dai Hall). Tuesday 4:30-5:30 (Jacobs Hall 110/120)

**Piazza Group** (for any course-related questions): <https://piazza.com/class/j6d5gzridxy1xy> (<https://piazza.com/class/j6d5gzridxy1xy>) (Or: just click on the Piazza link in the left hand menu)

If you have a technical question about your homework or project, please ask the class first through this group. For individual, class-related issues, use the private messaging feature on Piazza to reach all course staff. Do not send us individual email.

**Lab Fee:** Students will be expected to [get a Jacobs Hall Maker Pass](#) (<http://jacobsinstitute.berkeley.edu/our-space/makerpass/get-maker-pass/>). The regular Maker Pass is \$75. Students with demonstrated financial need can get a fee waiver. Expect additional out-of-pocket expenses for electronics and consumables for your class project.

**Lab Hours (Jacobs Hall):** Consult the [Jacobs Hall Access](#) (<http://jacobsinstitute.berkeley.edu/make-at-jacobs/access/>) page.

**Class Meeting Times:** MW 10:30am-12:30pm, 210 Jacobs Hall











**Textbook:** There is no required textbook for this class. There will be readings assigned for many lectures. The readings will be available online in bCourses. You may have to submit reading responses for those readings through bCourses assignments.

**Note that the schedule and assignments below are still tentative and will be updated for this year's offering**

## Course Summary:

Date	Details
Wed Aug 23, 2017	 <a href="#">Class 01: Introduction</a> ( <a href="https://bcourses.berkeley.edu/calendar?event_id=2133357&amp;include_contexts=course_1463946">https://bcourses.berkeley.edu/calendar?event_id=2133357&amp;include_contexts=course_1463946</a> ) 10:30am to 12:30pm
Thu Aug 24, 2017	 <a href="#">IDD Laser Cutter Training Session</a> ( <a href="https://bcourses.berkeley.edu/appointment_groups/11774">https://bcourses.berkeley.edu/appointment_groups/11774</a> ) 11am to Aug 25 at 11am
Mon Aug 28, 2017	 <a href="#">Get a Jacobs Hall Maker Pass</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817638">https://bcourses.berkeley.edu/courses/1463946/assignments/7817638</a> ) due by 9am  <a href="#">Reading: Getting Started in Electronics &amp; Pico Pro</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817663">https://bcourses.berkeley.edu/courses/1463946/assignments/7817663</a> ) due by 9am  <a href="#">Class 02: Electronics and Microcontrollers 101</a> ( <a href="https://bcourses.berkeley.edu/calendar?event_id=2133350&amp;include_contexts=course_1463946">https://bcourses.berkeley.edu/calendar?event_id=2133350&amp;include_contexts=course_1463946</a> ) 10:30am to 12:30pm
Wed Aug 30, 2017	 <a href="#">Reading: Text Entry Techniques, Switches</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817670">https://bcourses.berkeley.edu/courses/1463946/assignments/7817670</a> ) due by 9am  <a href="#">Class 03: Discrete Input and Text Entry Devices</a> ( <a href="https://bcourses.berkeley.edu/calendar?event_id=2133356&amp;include_contexts=course_1463946">https://bcourses.berkeley.edu/calendar?event_id=2133356&amp;include_contexts=course_1463946</a> ) 10:30am to 12:30pm
Fri Sep 1, 2017	 <a href="#">HW1 - Pico Pro Kit</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817639">https://bcourses.berkeley.edu/courses/1463946/assignments/7817639</a> ) due by 5pm  <a href="#">Laser Cutter Safety Training</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817648">https://bcourses.berkeley.edu/courses/1463946/assignments/7817648</a> ) due by 5pm  <a href="#">Pick up Microcontroller Kit</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817659">https://bcourses.berkeley.edu/courses/1463946/assignments/7817659</a> ) due by 5pm
Mon Sep 4, 2017	 <a href="#">Labor Day - No Class</a> ( <a href="https://bcourses.berkeley.edu/calendar?event_id=2133363&amp;include_contexts=course_1463946">https://bcourses.berkeley.edu/calendar?event_id=2133363&amp;include_contexts=course_1463946</a> ) 12am  <a href="#">Reading: O'Sullivan and Igoe, Transducers</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817667">https://bcourses.berkeley.edu/courses/1463946/assignments/7817667</a> ) due by 9am
Wed Sep 6, 2017	 <a href="#">Class 04: Continuous Input</a> ( <a href="https://bcourses.berkeley.edu/calendar?event_id=2133348&amp;include_contexts=course_1463946">https://bcourses.berkeley.edu/calendar?event_id=2133348&amp;include_contexts=course_1463946</a> ) 10:30am to 12:30pm  <a href="#">Soldering Tutorial</a> ( <a href="https://bcourses.berkeley.edu/appointment_groups/11811">https://bcourses.berkeley.edu/appointment_groups/11811</a> ) 7pm to 9pm
Fri Sep 8, 2017	 <a href="#">Set up GitHub account</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817674">https://bcourses.berkeley.edu/courses/1463946/assignments/7817674</a> ) due by 11:59pm
Sun Sep 10, 2017	 <a href="#">HW2 - Text Entry Device</a> ( <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817641">https://bcourses.berkeley.edu/courses/1463946/assignments/7817641</a> ) due by 11:59pm

Date	Details	
Mon Sep 11, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817669">Readings: RFID</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817669)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133355&amp;include_contexts=course_1463946">Class 05: Identity, Barcodes, Fiducials, RFID</a> (https://bcourses.berkeley.edu/calendar?event_id=2133355&include_contexts=course_1463946)	10:30am to 12:30pm
Wed Sep 13, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817664">Reading: LEDs and Motors</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817664)	due by 9am
	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817640">HW2 - Reflection</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817640)	due by 10:29am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133345&amp;include_contexts=course_1463946">Class 06: Actuation</a> (https://bcourses.berkeley.edu/calendar?event_id=2133345&include_contexts=course_1463946)	10:30am to 12:30pm
Mon Sep 18, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817642">HW3 - Game Controller or Instrument</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817642)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133349&amp;include_contexts=course_1463946">Class 07: Playtest, Project Kickoff</a> (https://bcourses.berkeley.edu/calendar?event_id=2133349&include_contexts=course_1463946)	10:30am to 12:30pm
Wed Sep 20, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817643">HW3 Playtest Reflection</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817643)	due by 9am
	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817646">Install Eagle</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817646)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133359&amp;include_contexts=course_1463946">Class 08: PCB Design</a> (https://bcourses.berkeley.edu/calendar?event_id=2133359&include_contexts=course_1463946)	10:30am to 12:30pm
Fri Sep 22, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817675">Team Collaborative Plan</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817675)	due by 5pm
Mon Sep 25, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817647">Install Fusion 360</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817647)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133342&amp;include_contexts=course_1463946">Class 09: Solid Modeling / C++ Programming</a> (https://bcourses.berkeley.edu/calendar?event_id=2133342&include_contexts=course_1463946)	10:30am to 12:30pm
Wed Sep 27, 2017	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133358&amp;include_contexts=course_1463946">Class 10: Solid Modeling 2 / C++ 2 / Assembly Tips &amp; Techniques</a> (https://bcourses.berkeley.edu/calendar?event_id=2133358&include_contexts=course_1463946)	10:30am to 12:30pm
Mon Oct 2, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817650">P1 - Project Brainstorm</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817650)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133344&amp;include_contexts=course_1463946">Class 11: Project Idea Presentations and Critique</a> (https://bcourses.berkeley.edu/calendar?event_id=2133344&include_contexts=course_1463946)	10:30am to 12:30pm
Wed Oct 4, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817671">Reading: UX for IoT</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817671)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133362&amp;include_contexts=course_1463946">Class 12: Interaction Design Patterns for Interactive Devices</a> (https://bcourses.berkeley.edu/calendar?event_id=2133362&include_contexts=course_1463946)	10:30am to 12:30pm
Fri Oct 6, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817644">HW4 - Enclosure Design [Extended]</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817644)	due by 9am
Mon Oct 9, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817666">Reading: Observation and Ideation</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817666)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133343&amp;include_contexts=course_1463946">Class 13: Wireless 1 - TCP/IP &amp; HTTP</a> (https://bcourses.berkeley.edu/calendar?event_id=2133343&include_contexts=course_1463946)	10:30am to 12:30pm
Wed Oct 11, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817660">Reading: Bluetooth</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817660)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133338&amp;include_contexts=course_1463946">Class 14: Bluetooth</a> (https://bcourses.berkeley.edu/calendar?event_id=2133338&include_contexts=course_1463946)	10:30am to 12:30pm
Fri Oct 13, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817651">P2 - Observe, Narrate, Compare</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817651)	due by 9am
Mon Oct 16, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817662">Reading: Crowdfunding</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817662)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133337&amp;include_contexts=course_1463946">Class 15: Business planning and Crowdfunding</a> (https://bcourses.berkeley.edu/calendar?event_id=2133337&include_contexts=course_1463946)	10:30am to 12:30pm
Wed Oct 18, 2017	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133368&amp;include_contexts=course_1463946">Class 16: Rapid Prototyping</a> (https://bcourses.berkeley.edu/calendar?event_id=2133368&include_contexts=course_1463946)	10:30am to 12:30pm
Mon Oct 23, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817661">Reading: Critical Perspectives on IoT Gadgets</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817661)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133346&amp;include_contexts=course_1463946">Class 17: In Class Work + Critique</a> (https://bcourses.berkeley.edu/calendar?event_id=2133346&include_contexts=course_1463946)	10:30am to 12:30pm
Wed Oct 25, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817652">P3 - First Prototypes</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817652)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133340&amp;include_contexts=course_1463946">Class 18: Prototype Presentations and Critique</a> (https://bcourses.berkeley.edu/calendar?event_id=2133340&include_contexts=course_1463946)	10:30am to 12:30pm
Mon Oct 30, 2017	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133341&amp;include_contexts=course_1463946">Class 19: Power Considerations, Energy Harvesting</a> (https://bcourses.berkeley.edu/calendar?event_id=2133341&include_contexts=course_1463946)	10:30am to 12:30pm
Tue Oct 31, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817637">First Part Order</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817637)	due by 1pm
Wed Nov 1, 2017	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133339&amp;include_contexts=course_1463946">Class 20: Addressing Failure in IoT UX Design</a> (https://bcourses.berkeley.edu/calendar?event_id=2133339&include_contexts=course_1463946)	10:30am to 12:30pm
Mon Nov 6, 2017	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133366&amp;include_contexts=course_1463946">Class 21: Work Session</a> (https://bcourses.berkeley.edu/calendar?event_id=2133366&include_contexts=course_1463946)	10:30am to 12:30pm
Tue Nov 7, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817673">Second Part Order</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817673)	due by 1pm
Wed Nov 8, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817653">P4 - Second Prototypes</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817653)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133354&amp;include_contexts=course_1463946">Class 22: Prototype Review and Critique</a> (https://bcourses.berkeley.edu/calendar?event_id=2133354&include_contexts=course_1463946)	10:30am to 12:30pm
Mon Nov 13, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817665">Reading: Manufacturing for Makers</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817665)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133353&amp;include_contexts=course_1463946">Class 22: Startup and Manufacturing Perspectives - Guest Speaker Panel: Steve Beck, Toymaker and Pit Pillatsch of Fitbit</a> (https://bcourses.berkeley.edu/calendar?event_id=2133353&include_contexts=course_1463946)	10:30am to 12:30pm
Wed Nov 15, 2017	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133367&amp;include_contexts=course_1463946">Class 23: Injection Molding</a> (https://bcourses.berkeley.edu/calendar?event_id=2133367&include_contexts=course_1463946)	10:30am to 12:30pm
Fri Nov 17, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817645">Individual Team Evaluation</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817645)	due by 11:59pm
Sun Nov 19, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817672">Revised Collaborative Plan</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817672)	due by 11:59pm
Mon Nov 20, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817668">Reading: Photography</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817668)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133352&amp;include_contexts=course_1463946">Class 24: Production Values: Photography, Poster, Demo, Video</a> (https://bcourses.berkeley.edu/calendar?event_id=2133352&include_contexts=course_1463946)	10:30am to 12pm
Wed Nov 22, 2017	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133361&amp;include_contexts=course_1463946">No Class - "Non-Instructional Day"</a> (https://bcourses.berkeley.edu/calendar?event_id=2133361&include_contexts=course_1463946)	12am
Mon Nov 27, 2017	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817654">P5a - Alpha Version</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817654)	due by 9am
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133364&amp;include_contexts=course_1463946">Class 25: Business Planning</a> (https://bcourses.berkeley.edu/calendar?event_id=2133364&include_contexts=course_1463946)	10:30am to 12:30pm
	<a href="https://bcourses.berkeley.edu/calendar?event_id=2133365&amp;include_contexts=course_1463946">HKN Course Evaluations</a> (https://bcourses.berkeley.edu/calendar?event_id=2133365&include_contexts=course_1463946)	12pm to 12:30pm
	<a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817677">Third and Final Part Order</a> (https://bcourses.berkeley.edu/courses/1463946/assignments/7817677)	due by 11:59pm

Date	Details
Wed Nov 29, 2017	 <a href="https://bcourses.berkeley.edu/calendar?event_id=2133347&amp;include_contexts=course_1463946">Open Project Work Time (https://bcourses.berkeley.edu/calendar?event_id=2133347&amp;include_contexts=course_1463946)</a> 10:30am to 12:30pm
	 <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817656">P6a - Project Poster (https://bcourses.berkeley.edu/courses/1463946/assignments/7817656)</a> due by 10am
Mon Dec 4, 2017	 <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817655">P6a FIXED - GROUP - Project Poster (https://bcourses.berkeley.edu/courses/1463946/assignments/7817655)</a> due by 10:01am
	 <a href="https://bcourses.berkeley.edu/calendar?event_id=2133360&amp;include_contexts=course_1463946">Class: RRR Week - Open Project Work Time (https://bcourses.berkeley.edu/calendar?event_id=2133360&amp;include_contexts=course_1463946)</a> 10:30am to 12:30pm
	 <a href="https://bcourses.berkeley.edu/calendar?event_id=2133351&amp;include_contexts=course_1463946">Final Presentations (https://bcourses.berkeley.edu/calendar?event_id=2133351&amp;include_contexts=course_1463946)</a> 1:30pm to 3:30pm
Wed Dec 6, 2017	 <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817657">P6b - Demo Deliverables (https://bcourses.berkeley.edu/courses/1463946/assignments/7817657)</a> due by 2:30pm
	 <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817676">Team Questionnaire (https://bcourses.berkeley.edu/courses/1463946/assignments/7817676)</a> due by 5pm
	 <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817636">Final Team Reflection (https://bcourses.berkeley.edu/courses/1463946/assignments/7817636)</a> due by 11:59pm
Wed Dec 13, 2017	 <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817649">OPTIONAL: Portfolium submission (https://bcourses.berkeley.edu/courses/1463946/assignments/7817649)</a> due by 11:59pm
	 <a href="https://bcourses.berkeley.edu/courses/1463946/assignments/7817658">P7 - Final Report and Video (https://bcourses.berkeley.edu/courses/1463946/assignments/7817658)</a> due by 11:59pm