

Week 6 homework***Due date reminder, etc.***

Please email your completed assignment to the course TA by Thursday, 5 pm of next week. Assignments that are late by at most one week will receive at most 50% of full credit. We will not grade anything submitted more than one week late.

When your homework submission includes one or more Arduino code files, please use the template **p398dlp_template.ino** as the starting point for your code. (I have it posted to the course homeworks web page.) Please fill in *all* of the fields shown in the template file.

In addition, your homework submissions—code, cell phone photos, etc. must include enough identifying information for us to tell who you are!

Status of your project, as I imagine it to be by the end of class, week 6

I want you to be at this point in your projects by the end of week 6's class:

- Group 1, piano: all four breadboards can record audio, and you are all able to generate frequency spectra of your audio recordings. You are able to identify the fundamental frequency and the first few overtones and can plot the relative intensities of these. During class you will visit a piano elsewhere on campus and record the notes C4 – C5 (C4 is middle C) and C7 – C8 (the highest octave on the standard piano keyboard).
- Group 2, LED vs. incandescent lamps: you continue to generate (and plot) spectra for various light sources and record separate spectra for an incandescent bulb driven at different voltages using that variac I found for you. Generate Python code to fit a blackbody spectrum to the incandescent data, thereby obtaining an estimate for the filament's temperature at each current. Your fit should include a measure of some sort of the "goodness" of the blackbody spectrum fit.
- Group 3, drone navigation: you have integrated data collection from a GPS, two DPS310s, a BME680, and an LSM9DS1 into your DAQ. You are able to integrate the accelerometer information to produce a position and altitude estimate. You can also interpret the DPS310 data to determine changes in altitude. You are aware that there are limitations to the integration technique due to accelerometer drifts and offsets.
- Group 4, bus vibrations: you are combining GPS, BME680, and accelerometer data into records you write to an SD file and are doing initial field tests on an MTD bus during part of Friday's class.
- Group 6, paper production: you are reading multiple BME680s using an I2C multiplexer, can control a motor-driven paper agitator and are able to record audio from agitating a sheet of paper. Using python, you can display the environmental data, as well as generating the frequency spectrum of the paper audio. During class you head to Prof. Benson's paper fabrication studio and make your first recordings of temperature, pressure, humidity, etc. in his studio.

Assignment: members of a group should submit a single joint response (not individual responses) to the assignment

Group 1, piano:

- (a) Analyze (and compare) the overtone spectra for the C4 – C5 and C7 – C8 recordings.
- (b) Find a reasonably capable violinist and have them play a scale for you. Make a separate set of recordings (one “button push”) for each note. Analyze the overtone spectra and compare/contrast the overtone ratios with what you found for the piano.
- (c) Identify **clearly and explicitly** the work done by each of the individual group members in preparing your response to this assignment.

Group 2, LED vs. incandescent lamps:

- (a) Write a coherent technical memo (Perhaps about five pages in total length???) in which you briefly describe your method and measurements, and present the spectral data for the different light sources, as well as what you’ve learned from your blackbody fits.
- (b) Identify **clearly and explicitly** the work done by each of the individual group members in preparing your response to this assignment.

Group 3, drone navigation:

- (a) Write a coherent technical memo (a few pages in length) in which you briefly describe your methods and measurements, and discuss QUANTITATIVELY the limitations (as a function of total integration time) to the precision of your inertial navigation technique. Also describe the level of agreement of the change-in-altitude determinations obtained from the two DPS310s.
- (b) Identify **clearly and explicitly** the work done by each of the individual group members in preparing your response to this assignment.

Group 4, bus vibrations:

- (a) Ride the same MTD bus route several times and overlay your trajectory on a map. Look for position-dependent correlations in the acceleration vs. position data. Also plot the frequency spectrum of the bus accelerations.
- (b) Identify **clearly and explicitly** the work done by each of the individual group members in preparing your response to this assignment.

Group 6, paper production:

- (a) Make more measurements of the complete paper production cycle in Benson’s lab and write a short technical memo describing what you found.
- (b) Identify **clearly and explicitly** the work done by each of the individual group members