Each team was given two Arduino microSD card SHIELD kits in class on September 10, 2015. These will be used for this homework as well as upcoming in-class exercises. It is expected that everyone on the team meaningfully participate with this homework. Each team shall bring hardware from HW #04 plus hardware built below to class on September 15th and 17th. **ALL STEPS SHALL BE COMPLETED BEFORE CLASS TO RECEIVE CREDIT FOR THIS ASSIGNMENT.**

1. Build and solder your Arduino microSD Shield Kit (2 per team). There are no instructions but it is fairly simple. Build exactly as shown in the pictures below. Header connectors must be perpendicular and flush with to the Shield board. Solder connections are made on the bottom of the board. **DO NOT TRIM LEADS OF THE BLACK HEADER PIECES.**

![Arduino microSD Shield Kit](image1.png)

2. Add the header connector to the 3 axis accelerometer (only 1 per team) exactly as shown. Connector needs to be perpendicular to the accelerometer board as shown. Solder connections are on top of board. Please note that the longer leads should be on bottom of board along with the black support piece. Do not solder until your hardware matches the picture on the bottom left. **DO NOT TRIM LEADS OF THE BLACK HEADER PIECES. DO NOT SOLDER ACCELEROMETER TO BALLOON SHIELD.**

![3 axis accelerometer](image2.png)
3. Find the data sheet for this 3 axis accelerometer on the Sparkfun website. Save a copy to your laptop. Find out how to convert from voltage to Gs by using the data sheet and show method/equation below. Also understand and determine the settings needed to configure this sensor for your balloon flight.

4. Add the header connector to the humidity sensor (only 1 per team) exactly as shown. Connector needs to be perpendicular to the humidity board as shown. Solder connections are on top of the board. Please note that the longer leads should be on bottom of board along with the black support piece. Do not solder until your hardware matches the picture on the bottom left. **DO NOT TRIM LEADS OF THE BLACK HEADER PIECES. DO NOT SOLDER HUMIDITY SENSOR TO BALLOON SHIELD.**

5. Find the data sheet for this humidity sensor on the Sparkfun website. Save a copy to your laptop. Find out how to convert from voltage to RH using the data sheet and show method/equation below. Also understand and determine the settings needed to configure this sensor for your balloon flight.

6. Solder the 2 330 ohm resistors to the Balloon Shield as shown. Solder from back side of board and trim leads.
7. Solder 2 two pin headers to the D4 and D3 location on your Balloon Shield. **Short pins go into board and are soldered from bottom of board. Long pins should be on top.** This is very important.

8. Solder 1 3 pin header to the TEMP2 location on your Balloon Shield. Short pins go into board and are soldered from bottom of board. Long pins should be on top. This is very important. **DO NOT install the other sensors that are shown (including Temp 1).** Pictures show additional hardware installed. Please ignore for now.
9. What is an analog sensor?

10. Identify the analog plot and the digital plot.

11. What does ADC stand for?

12. What does an ADC do?

13. Does the Arduino Uno have one and if so what resolution is it (4 bit, 8 bit, 10 bit, 16 bit, etc)?

14. How many states are in a 2 bit digital conversion?

15. How many states are in a 8 bit digital conversion?

16. How many states are in a 10 bit digital conversion?

17. How do you convert a 10 bit digital value back to an analog value if the analog range is 0 to 5 V?

18. Using your method in question 18, complete the following conversions in the graphic below: