EE 185 Portfolio

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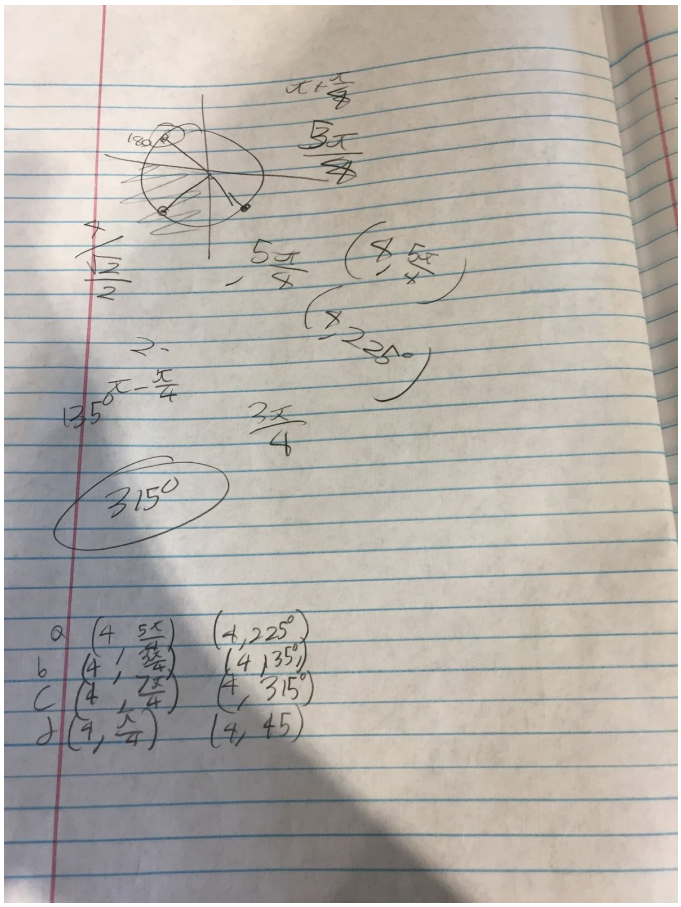
Throughout the semester I learned about communication and critical thinking. I learned this through the many games and labs. Although I had the correct answer almost all the time, my main issue with the games was formatting the problems effectively and showing my work. This can be seen from one of my first scans below where the work isn't easy to follow.

Game 6:



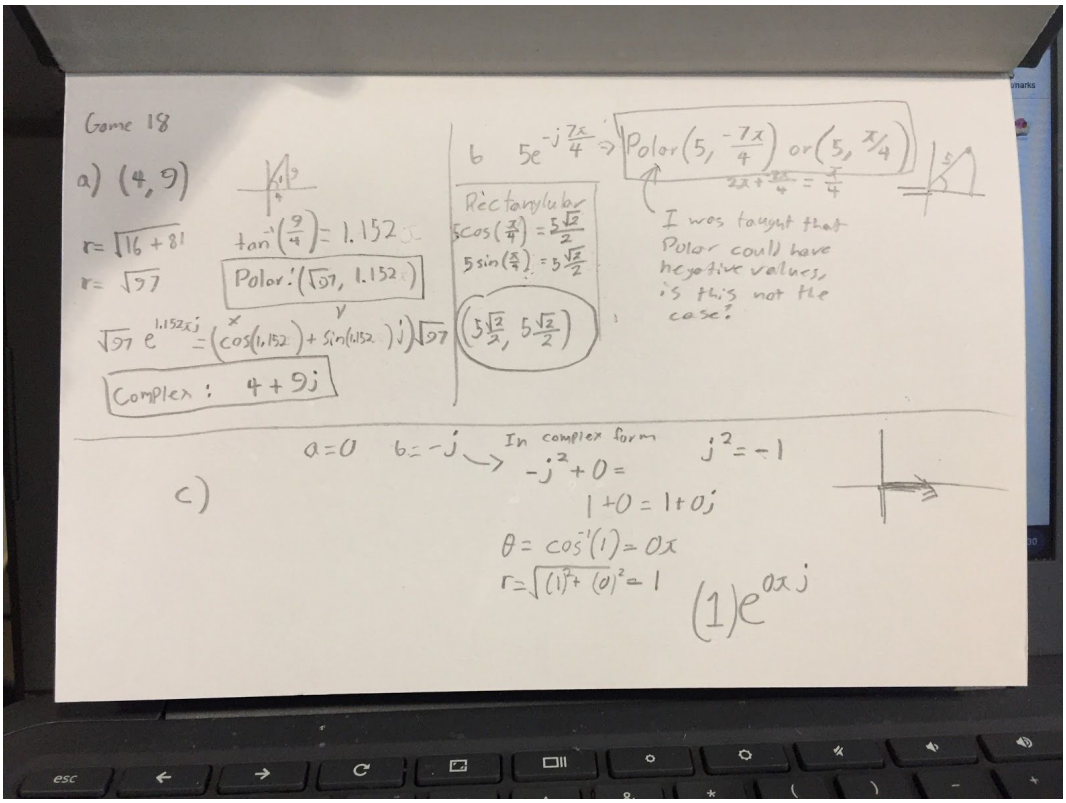

The answers are shown. but the supporting work is not organized in a way that someone could easily follow. I used the unit circle to find the quadrants for each of the 4 problems but this cannot easily be seen. and there isn't much thought to layout or even orientation.

Throughout the semester my games got better in terms of layout designs as well as image quality. One of my later games shown below demonstrates the improvement in formatting. This formatting is helpful for someone else to review the problem and solution and also for referencing the material for later classes.

In this later example I clearly write the game number as well as section out the page for each problem.

I also ask questions and have arrows to show thinking.

This could still be improved with a more standardized layout as well as better spacing on questions as part C has too much space.




In this class I really enjoyed the lab portion. One problem I had in the beginning was not providing much detail on the procedure as well as the conclusion. In one of my early labs I wrote this for my procedure:

In this section you will explain your approach of working through different problems/questions/tasks you attempted during the lab.

**State the Task/Problem/Question Attempted**

**Procedure**

**Explain in detail** what you did to find the answer to your question. The reader should be able to follow your procedure and repeat exactly what you did.

- *Installed Matlab*
- *Ran the trial codes in the command line*
- *Made a new file*
- *Ran code from file*
- *Created different sections*
- *Ran as section*
- *Created own code in new file*

Lab 3: _____

This was not enough because it was just a checklist of what I did rather than showing any reasoning or images of what I was doing.

Then for some of my later labs, I wrote this amount for just one of the challenges.

**Challenge #2:Have MATLAB create an array with 10 random elements ranging from 1-100. First, rearrange the 10 elements in increasing numbers and print out the array. Next, have MATLAB sort the 10 elements into odd and even numbers.**

```
array = [];
for i = 1:1:10
 array(i) = randi(100);
end
array = sort(array);
disp("in order array" + array);

even =[];
odd = [];
for i = 1:1:10
  if(mod(array(i),2))
    odd(length(odd)+1) = array(i);

  else
    even(length(even)+1) = array(i);
  end
end
disp("odd");
disp(odd);
disp("even");
disp(even);
```

```
odd
    19    39    45    49    65    71    77

even
     4    44    80    96
```

I first had it go through 1-11 in the for loop but that caused there to be 11 values instead (matlab for loop includes the last one. It is "<=" rather than just "<")

It first assigns random numbers to the array then goes into the second loop.

In the second loop it checks if the remainder of i value in the array and 2. This is because it will return 1 if there is a remainder (true so it is odd) or 0 if it is even (because there isn't a remainder). It then adds it to the correct array and prints them out.

In this report I showed my hiccups as well as my reasoning as I created the code. These extra comments (and images) are much more useful to me then a checklist of what I did or a couple of summary sentences describing what a huge block of code does.

I kept writing more for the reports because I realized that it was helpful if I ever wanted to go back to review my logic. I also found that in my explanations I would have to think about how to word things in order to make it more understandable. One example of this was when I was exploring a more unique solution to a challenge problem. I thought that the easiest way would be to use bitwise operators but since we didn't cover them I thought of giving them an explanation that took a while to write out.

EXTRA: What if we dial up the difficulty of this challenge? Are you familiar with binary counting? With four LEDs, we can count to 15 in binary by having 0's as dimmed LED and 1's as lighted LED. For example, 0 is 0000 which is four dimmed LEDs. Another example, 10 is 1010 which is 2 dimmed LEDs (1st& 3rd from right to left) and 2 lighted LEDs (2nd& 4th from right to left). Have the user input a value and MATLAB will display the binary equivalent on the LEDs. You can scale up the limit by increasing the number of LEDs.

In order to do this you can get the parts of the int via bitwise operators

(n >> k) & 1 (n is the integer and k is the bit wanted)

this is done because to find the k bit we shift the int over that many to have that bit in the 0-1 place of the int

Example: 10100>>2 = 00101

This then gets combined with the & (and) bitwise operator where only bits that are both true will be considered still true

Example: 10100 & 11011 = 10000 (only the 5 bit are both true)

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If we use 1 (0001) then only the last bit would be true so any & operation would be testing the last bit (or if we shift it any individual bit)

```
int n = 5;
 digitalWrite(1, (n >> 0) & 1); //bit 0
 digitalWrite(2, (n >> 1) & 1); //bit 1
 digitalWrite(3, (n >> 2) & 1); //bit 2
 digitalWrite(4, (n >> 3) & 1); //bit 3
```

if you wanted to make it scalable you could use a for loop to go through all of the bits

I feel that bitwise operators are especially useful for electrical engineering programming because of their use for microcontroller registers. I learned this use when in the free labs. In some of the free labs I worked with an Attiny13A to create a motion sensing piston (it would open a door or lid when you hit an object). This required accessing the pins on the Attiny as well as the analog to digital converter. I looked up the datasheets and pasted what I found into my report.

Next would be porting it to an ATtiny13 on atmel studio. Sadly the analog inputs are not as easy with Atmel, you need to work directly with the registers to activate the analog to digital converter (ADC)

**THEORY OF OPERATION:**

| | 7 bit | 6 bit | 5 bit | 4 bit | 3 bit | 2 bit | 1 bit | 0 bit |
|---|---|---|---|---|---|---|---|---|
| **ADMUX** | REFS1 | REFS0 | ADLAR | - | MUX3 | MUX2 | MUX1 | MUX0 |

*ADC Multiplexer Selection Register*

| REFS1 | REFS0 | Voltage Reference Selection |
|---|---|---|
| 0 | 0 | AREF, Internal Vref turned off |
| 0 | 1 | AVcc with external capacitor on AREF pin |
| 1 | 0 | Reserved |
| 1 | 1 | Internal 1.1V (ATmega168/328) or 2.56V on (ATmega8) |

*REF Bits*

I am going to drop the last 2 bits because I don't need that much accuracy in this project.

I really enjoyed the free labs. Below are some of the later labs that I found most interesting.

Free Lab 1 - Rock, Paper, Scissors Game
https://drive.google.com/file/d/17ZzHYb-TdtUJhAl9Mmm2aBbF11pAJRgX/view?usp=sharing

Free Lab 2 - Intro to AVR Microcontroller Programming and Relays
https://drive.google.com/file/d/1tZj4RgmYpedoV0MmYnVRxOvoppMAP6eu/view?usp=sharing

Free Lab 3 - Playing with 555 Timer Circuit
https://drive.google.com/file/d/1gWSHnNdU_fducwZ8ystTa7-TNlv19srH/view?usp=sharing

Free Lab 4 - Finishing AVR Microcontroller Programming
https://drive.google.com/file/d/1ziF6eDQuSqN2aDDWatSR5a5a-A5sdHby/view?usp=sharing

> Below is the link to the video from Lab 4 of the accelerometer turning on and off the relays (that would connect to the leads to the pistons):
> https://www.youtube.com/watch?v=2zz9vpvJkSQ

Overall I really liked how this course didn't exclusively focus on learning technical elements of electrical engineering as much as general skills in learning, documentation, and reasoning. My favorite part was the labs because they were more hands on and allowed for more exploration. Now that the semester is finished, I have many things I started in the labs that I plan to complete and learn more about. Of my first semester courses, I believe this course will be the most beneficial going forward because of the solid foundation it provided for future success in learning in other courses and in work.