In place of a signature, please include a commented statement in your code affirming your recognition of the Academic Honesty Policy for the Final Exam. You will replace the blank with your name and UHID as an acknowledgement in your starting file as acknowledgement of this policy.

```
% I, <INSERT FULL NAME> (<INSERT UHID>) acknowledge that Final Exam for ENGI 1331,
% is to be completed by myself with no collaboration with anyone.
% I have read the ENGI 1331 Position on Academic Honesty and agree
% to abide by its provisions while taking this exam.
% I acknowledge that my submission will be run through a similarity code.
% Any student with unacceptable levels of commonality with peers or
% other sources will be brought up for an academic honesty violation.')
```

INSTRUCTIONS:

This virtual computer exam will be given on Wednesday, August 5, 2020.

- You must be logged in with video on to your virtual classroom during the entire exam. If you lose connection during the exam, re-enter the virtual classroom and proceed with the exam.
- Computer with internet access and video is required.

General Rules

- You should **suppress** all output to the Command Window except if specific formatted output is requested.
- You must use any variable names specified. **If a variable name is not specified, you may create your own name for the variable.**
- **Do Not Hard Code for a specific case – your code must be flexible based on the instructions provided.**

Exam Timeline

Programming in MATLAB (only portion): This exam should take you approximately 1 hour and 30 minutes to complete and 15 minutes for planning and 5 minutes to upload your code. Total time is 1 hours and 50 minutes.

Finishing the exam

You will **have 1 hours and 30 minutes to complete all tasks after the 15 minute downloading/planning period and 5 minutes to upload code**. After time is called, you will be expected to close out of MATLAB and zip your exam folder.

- During the exam, **NO COLLABORATION**, or you will be dismissed with a **ZERO**.

After the exam is completed and the file collected, any procedure (such as opening the file) which alters the date / time stamp of the file will void any allowances for mis-saved files – in other words, **after the exam is over DO NOT OPEN the file again!**

Saving Exam File

You will be expected to have one script file associated with your exam submission and any starting files or exported files. Save your script file in the exam folder on your desktop as **FinalExam_cougarnet.m**. Any naming convention for functions should be followed and saved in the same folder. You must submit a .ZIP file named **FinalExam_cougarnet.zip** that contains the script and function(s) necessary to run your code.

Background: *You are an electrical engineer tasked with analyzing various circuits to determine the operating conditions. Your co-worker has provided you with measurements for 2 different circuits. The first being an ideal resistor circuit, and the second being a semiconductor circuit. Along with these measurements, you are also provided with a table of data points to check.*

You are provided with three .csv files which contain all of the measurements from your coworker as Data1, Data2, and Data3. The following tables contain that same information (ONLY the numeric part of each table is included in the .csv files). Data1 corresponds to the information for the ideal resistor circuit, Data2 corresponds to the semiconductor circuit, and Data3 are the points you will use to check the phases. NOTE: Each data set will always be given for only Voltage (Row 1) and Current (Row 2), but may include additional measurements (columns) for each circuit.

Ideal Resistor (Data1)	*Voltage (V) [V]*	*137*	*183*	*211*	*275*
	Current (I) [A]	*1.522*	*2.033*	*2.344*	*3.056*

Semiconductor (Data2)	*Voltage (V) [V]*	*87*	*145*	*201*	*234*
	Current (I) [A]	*0.141*	*0.506*	*1.146*	*1.675*

Phase Point Checks (Data3)	*Voltage (V) [V]*	*20*	*155*	*122*	*300*	*255*	*202*	*101*	*83*	*55*
	Current (I) [A]	*0.553*	*0.224*	*0.746*	*2.25*	*3.250*	*3.175*	*1.775*	*0.575*	*1.175*

Tables - Input Data Measurements

Task 1 [25 pts]: Determine the equation for the ideal resistor (Data1) using a linear fit and determine the equation for the semiconductor (Data2) using a power fit. Assuming the first intersection point occurs at zero, determine the other intersection point of the two curves. You can assume it occurs near 300 [V]. Output the equations and the non-zero intersection points to the command window as shown in the sample output.

Task 2 [10 pts]: Create a plot that includes the following elements:

- The experimental data sets for both the ideal resistor and semiconductor as points using different colors and marker shapes.
- Create an axis range that goes from (0,0) to the other intersection point (determined in Task 1)
- Add both trendlines from Task 1 to your plot matching each one to the color of the experimental data it represents. The trendlines should extend only from one intersection point to the second intersection point.

Task 3 [10 pts]: Output some basic information about the resultant fit equations. Based on Ohm's law $V = IR$, the resistance R of an ideal resistor is represented by the inverse of the slope of the linear equation (i.e. the slope of the linear trendline is equal to 1/R). Output the resistance for the ideal resistor only to the command window as shown in the sample output.

Another piece of information that can be found from the graph is the power for each circuit. The applicable equation for power here is $P = IV$. Therefore, the power is represented graphically by the area under each fit equation, from 0 [V] to the curves' intersection. Output the power for the ideal resistor circuit and the semiconductor circuit.

Task 4 [24 pts]: Load in the Data3.csv as **POINTS**. Determine where each measurement is located on the graph, BOTTOM for below the semiconductor, MIDDLE for above the semiconductor and below the ideal resistor, TOP for above the ideal resistor. If the point is on the line, assume it is the MIDDLE.

- Create a string array named **PHASE** that contains the phase labels BOTTOM, MIDDLE, or TOP. The length of the string array should equal the number of columns in **POINTS**.
- Determine the number of points that are in each phase. Create a formatted output to the command window stating the number of points found in each phase.

NOTE: You may make the assumption that the curve for the ideal resistor will always be above that of the semiconductor over the range of interest.

Plot each point with the color according to the phase. For BOTTOM, plot the point as blue, for MIDDLE, plot the point as black, and for TOP, plot the point as red.

Task 5 [31 pts]: Load the image file provided. For this output image, you will need to separate the image into thirds vertically as shown in the image below. You can assume the image is divisible by three vertically (number of rows).

Create a menu that asks the user which third of the image to apply the image manipulation (BOTTOM, MIDDLE, or TOP)

- If the user selects BOTTOM, only apply the image manipulation to the <u>bottom</u> third of the image.
- If the user selects MIDDLE, only apply the image manipulation to the <u>middle</u> third of the image.
- If the user selects TOP, only apply the image manipulation to the top <u>third</u> of the image.

Within the region of interest, find all pixels that are not black and change to yellow (high red, high green, low blue). Output the number of pixels that were changed as the title of the filtered image and display your original image and filtered image in a new figure (1 x 2 subplot).

Ask the user if they want to repeat Task 5 and manipulate the original image again. If yes, repeat Task 5. If no, the program should end.

<u>Sample Output on Next Page</u>

Sample Output (Command Window for data given)

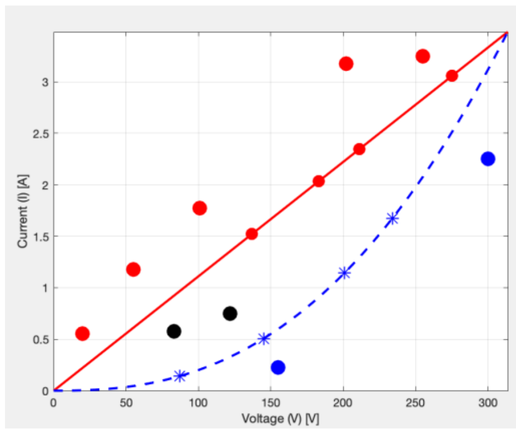
Command Window

```
Ideal Resistor: I = 0.01V + -0.00
Semiconductor: I = 1.98e-06 V^(2.50)
The intersection points occur at 313.57.

For the ideal resistor, the resistance is 89.96 [Ohms].

The power produced by the ideal resistor circuit is 546.13 [W].
The power produced by the semiconductor circuit is 312.04 [W].
Bottom Phase Count: 2
Middle Phase Count: 2
Top    Phase Count: 5
>>
```

Sample Output (Figures for data given)



NOTE: For the image below, TOP was selected from the menu.