ECE 540 **HW1 – Intro to MATLAB** **Spring 2018**

1.a) In the case of the average height of men, the reported "average" was much more precise that could be measured. In fact the daily growth of many young men would undoubtedly make this a moving target. The text referred to this as Fictitious Precision.

1.b) This graph is known as a Gee-Whiz graph, which means that it is done to make the reader be impressed with the change. However the relative change in the quantities is not that large. The graph can be corrected, to more realistically represent the data by scaling the plot to include a zero point on the y axis.

2) The code is included in Appendix A. The plot generated from this code is include on the next page.

3) The function requested in Appendix B.

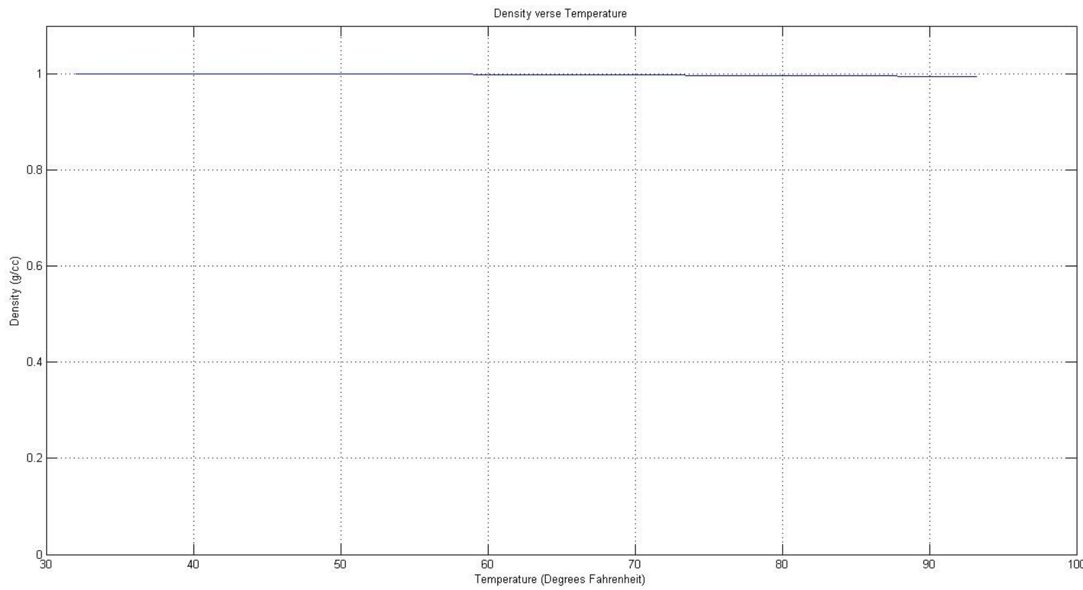
4) The final section of the main function computes precision for various base numbers. The beginning and end of the data generated by this code is shown here.

```
1,2.220446049250313e-16,2.220446049250313e-16
0.1,1.110223024625157e-17,1.110223024625157e-16
0.01,1.110223024625157e-18,1.110223024625157e-16
...
1e-28,1.110223024625157e-44,1.110223024625157e-16
1e-29,1.110223024625157e-45,1.110223024625157e-16
1e-30,1.110223024625157e-46,1.110223024625157e-16
```

And by far the most interesting thing is how the ratio, or third entry stays constant. One way to interpret this is that what is small is a function of the numbers being used. Also, in cases where we are trying detect when a number is small, a ratio would allow us to better assess the "size" of an error or deviation.

From this we can see that ratio is by far the more useful term.

Below is a linear plot of this data, from which it should be noted that all points seem to merge to one spot on the left hand side. For this reason a second log-log plot was done to try and show the range of the data. The log-log plot shows that the precision and base are related, based on the order of magnitude of each. The log-log plot also emphasizes that the ratio of precision and base is flat over most of the values of base.


Density verse Temperature
Density (g/cc)
Temperature (Degrees Fahrenheit)
0
0.2
0.4
0.6
0.8
1
30
40
50
60
70
80
90
100

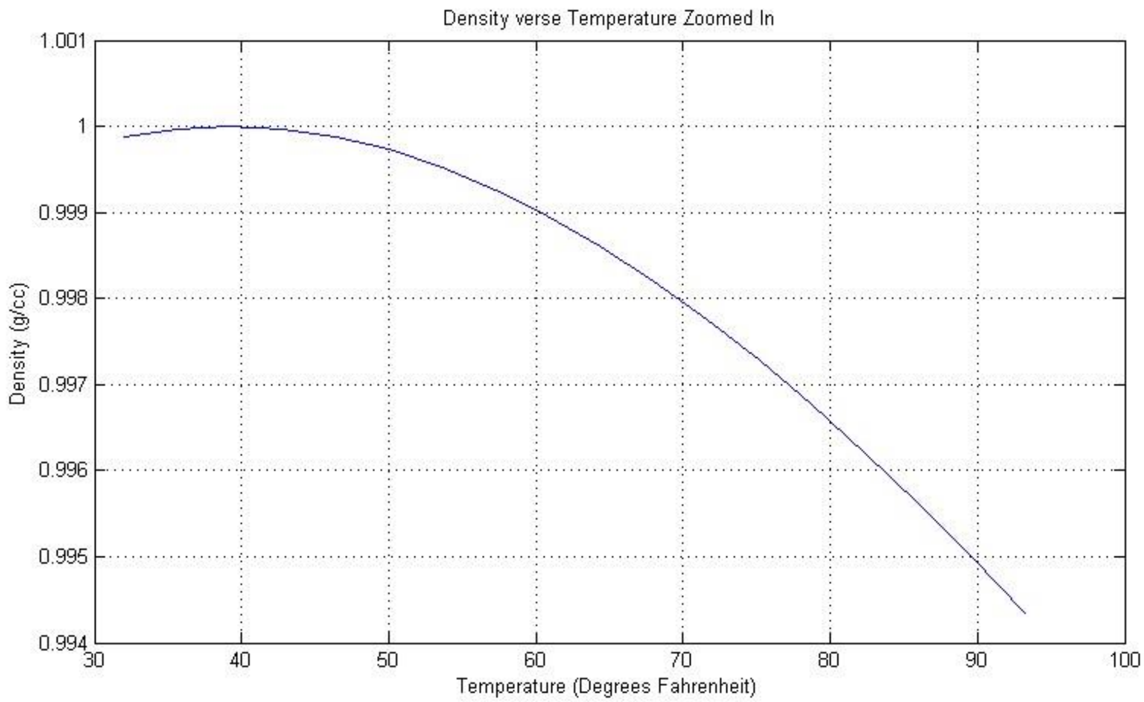


Figure 1A. Temperature Versus Density Figure 1B.

Temperature Versus Density – Close Up.

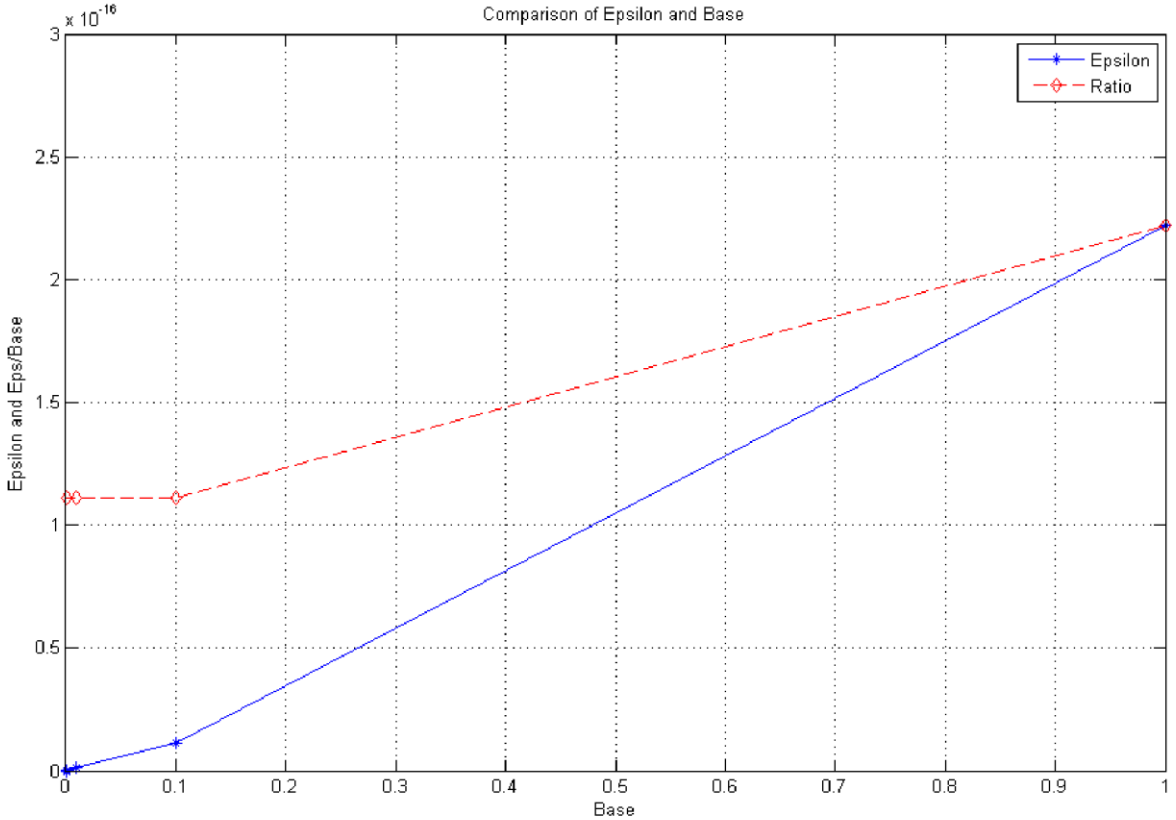


Figure 2A. Base Versus Precision Using a Linear Scale

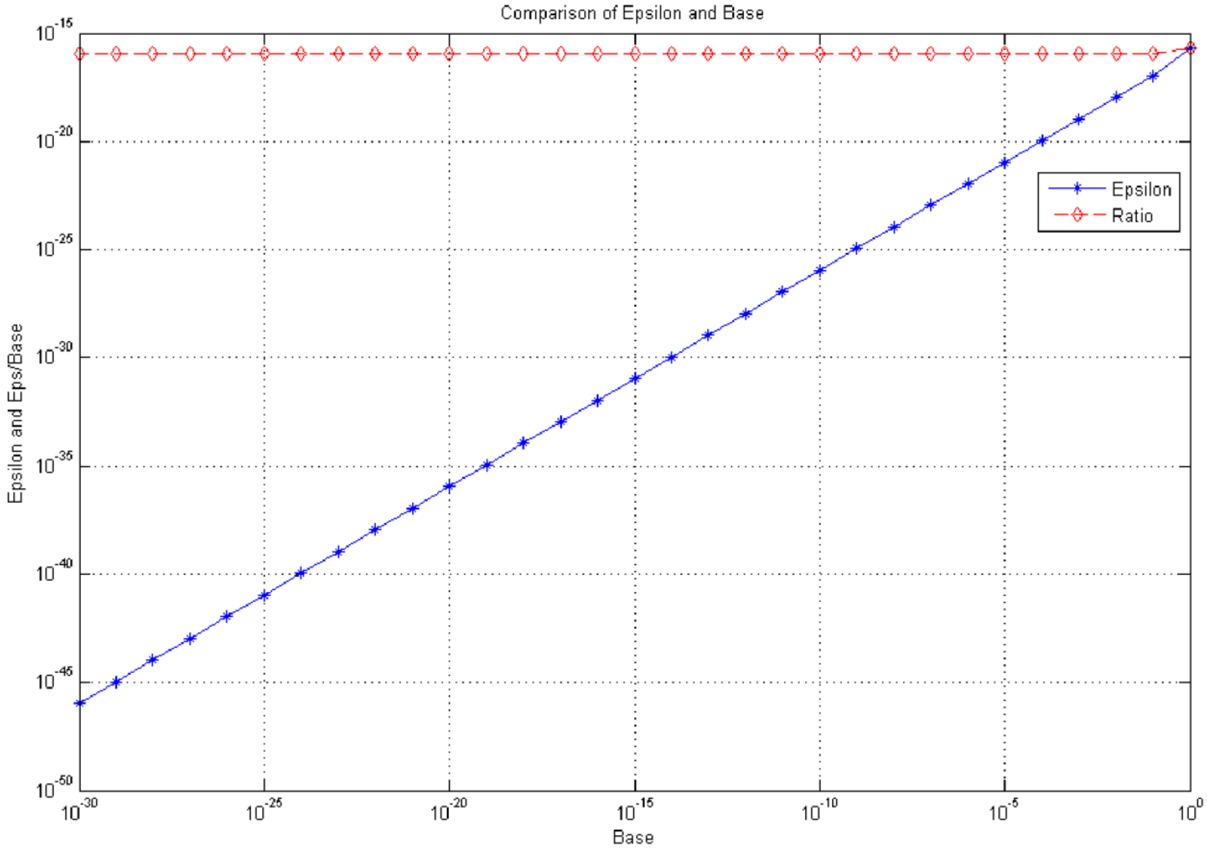


Figure 2B. Base Versus Precision Using a Log Scale Appendix A: Code for Home Work 1 Problem 2) Function

```
function density = TemperatureToDensity( TemperatureC )
%
% density = TemperatureToDensity(Tc);
%
 density =  5.289e-8   * TemperatureC.^3   ...
- 8.5016e-6 * TemperatureC.^2  ...
         + 6.5622e-5 * TemperatureC     ...
         + 0.99987;
end
```

Test of Density function.

```
% Generate range of temperatures
TemperatureC = [0:2:34];

% Convert temperatures Farenheit to Density and temperatures in Celsius
[DensityWater] = TemperatureToDensity( TemperatureC ); TemperatureF =
9*TemperatureC/5+32; % Convert temperatures to Fahrenheit.
```

```
% plot results.
figure(1)
plot( TemperatureF, DensityWater );
ylim([0 1.1]);
title( 'Density verse Temperature' ); xlabel(
'Temperature (Degrees Fahrenheit)' ); ylabel(
'Density (g/cc)' );
grid

% Plot and allow tight scaling
figure(2)
plot( TemperatureF, DensityWater ); title(
'Density verse Temperature Zoomed In' );
xlabel( 'Temperature (Degrees Fahrenheit)' );
ylabel( 'Density (g/cc)' );
grid
```

Appendix B: Code for Problem 2 and 3)

Function

```
function Precision = PrecisionVersusBase( Base )
%
% Precision = PrecisionVersusBase( Base )
%
% Search for Precision as a function for Base % Input: Base - Number
that represents the size of numbers processed.
% Output: Precision - Number representing the size of last bit.
%

Precision = Base; % initial value of precision (have to start somewhere)

while Base+Precision > Base % Loop until Precision no longer effect Base
Precision = Precision / 2.0; % Reduce Precision by one bit.

end % end of while

Precision = Precision * 2.0;

return;
```

Script that will test the relationship of Base and Precision

```
% Test the relationship between Precision and Base.
close all clear  % Set up Base and index.
B = 1.0;
k = 1;
% Loop until base is below 1e-30.
while B >= 1e-30
    Base(k) = B; % Save base value
    Precision(k) = PrecisionVersusBase( B ); % Save Precision
```

```
    B = B / 10.0; % Move to next sample.
k = k + 1; end
% Save data to file
Double2CSV( [Base' Precision' (Precision./Base)'], 'BaseVsPrecision.csv' );

% Plot data with linear scale.
figure(1)
plot( Base, Precision, 'b*', Base, Precision./Base, 'rd--' );
title( 'Relationship between Base and Precision' );
xlabel( 'Base' );
ylabel( 'Precision and Ratio' );
legend( 'Precision', 'Ratio' );
grid;

% Plot data with log-log scale.
figure(2)
loglog( Base, Precision, 'b*-', Base, Precision./Base, 'rd--' );
title( 'Relationship between Base and Precision' );
xlabel( 'Base' ); ylabel( 'Precision and Ratio' );
legend( 'Precision', 'Ratio' );
grid;
```