CS2035b Data Analysis and Visualization - Lab 5

General Lab Instructions to Help Labs Run Smoothly

- Read through the lab instructions **before** coming to the lab.
- Do any required pre-lab preparation.
- Bring a **printed** copy of the lab instructions to the lab.

Overview and Preparation

This (and all subsequent) labs will be using MatLab 2016b as installed in the Health Sciences 16 general computing lab. You must attend this lab in HSB14 or HSB16 in order to get assistance from the TA. You must sign the lab attendance sheet in the lab. You can use your UWO login/password to login to these machines. Lab submission is to be done via Owl. Remember, labs are worth 10% of the total grade for this course (there are 11 labs in total, you must do 8 to receive full marks).

Upon completion of this lab, you should have done the following in the MatLab environment:

- Created a file, output05.txt, containing the input and output for the MatLab code run in this lab. Again create output05.txt as a diary file.
- Submit this file (output05.txt) plus all the created images (as a single zip file, images05.zip) via the course Owl page.

Exercise: 2D and 3D Graphs

Consider the following MatLab code segments that plot 2D and 3D graphs. Answer the questions.

1. Consider the following MatLab code seqment. What happens to the 1^{st} graph after the stem graph is computed? Modify this code segment so that both graphs remain displayed

at the end of execution of this seqment (need to use `figure`). Save the 2 graphs as `plotone.jpg` and `stemone.jpg`.

```
x=-pi:0.1:pi;
y=sin(x);
plot(x,y)
stem(x,y)
```

2. Consider the following MatLab code seqment. Do you see why meshgrid is required and what it does? Note the difference between `surf` and `mesh`. Save the `surf` and `mesh` plots as `surfone.jpg` and `meshone.jpg`.

```
[X,Y] = meshgrid(-2:.2:2, -2:.2:2);
Z=X.*exp(-X.^2-Y.^2);
X
Y
Z
figure
surf(X,Y,Z)
print surfone.jpg -djpeg
figure
mesh(X,Y,Z)
print neshone.jpg -djpeg
```

3. Note the difference between `mesh` and `meshc`. Save the graphs as `meshtwo.jpg` and `meshctwo.jpg`.

```
[X,Y] = meshgrid(-2:.2:2, -2:.2:2);
Z=X.*exp(-X.^2-Y.^2);
mesh(X,Y,Z)
meshc(X,Y,Z)
```

4. View the plot of many functions together. Save the graph as `multigraph.jpg`.

```
t=0:pi/50:2*pi;
y1=sin(t);
y2=cos(t);
y3=sin(t-0.25);
y4=cos(t-0.25);
plot(t,y1,t,y2,t,y3,t,y4)
print multigraph.jpg -djpeg
```

5. What is plotted here? What does `meshgrid` do with one argument? Save the graph as `meshthree.jpg`.

```
g=0:0.2:10;
[X,Y]=meshgrid(g)
Z=2*sin(sqrt(X.^2+Y.^2));
mesh(Z);
print meshthree.jpg -djpeg
```

6. Consider the following 3D plot. What is the effect of `rotate3d on`? Can you view the surface from multiple viewpoints? Save one of the views as `rotateview.jpg` (use `file --> save as` to do this).

```
x=-4.0:0.1:4.0;
y=-3.0:0.1:3.0;
[X,Y] = meshgrid(x,y);
Z = X.^2 - 2*(X.*Y) + 3*Y + 2;
rotate3d on;
surf(X,Y,Z)
axis([-4 4 -3 3 -15 40])
% hsv, hot, cool, pink, gray, bone, copper, prism,
% and flag are other possible colour maps
colormap(jet);
```

7. Consider the following plots. Save the surface as `surftwo.jpg` and the contour plots as `contourtwo.jpg` (the latter creaded after the `hold on`) .

```
colormap(jet); % Set colors
x=-2:.1:2; y=x; % Set up x and y as vectors
[X,Y]=meshgrid(x,y); % Form the grid for plotting
Z=X.^2 - 2*(X.*Y) + 3*Y + 2;
rotate3d on; % Activate interactive mouse rotation
surf(X,Y,Z+10)  % Draw surface
shading interp; % Use interpolated shading
print surftwo.jpg -djpeg
hold on; % Allow for more without erasing
axis([-2 2 -2 2 0 25]); % Set up axes
xlabel('X');
ylabel('Y');
contour3(X,Y,Z+10,30); % 3D contour plot over surface
contour(X,Y,Z+10,30);  % 2D contour plot in x,y-plane
print contourtwo.jpg -djpeg
```

8. Consider the surfaces $z = x^2 - y^2$ and $z = xy$. These are saddle surfaces, centered at 0,0. For `x=-4:0.1:4` and `y=x` plot these saddles and save in `saddles1.jpg` and `saddles2.jpg`

9. Plot $z = 4500 - 105x^2 - 3y^2x^3 + 0.8x^4 + 0.8y^4$ for the square $-10 \leq x, y \leq 10$ (use `x=-10:0.1:10` and `y=x`). How many peaks and pits do you see? What about saddle-shaped pieces? Label the main peak with the label `Peak` using`text`. Save this in file `fctone.jpg`.

10. Zoom in on the above graph without the text by changing the axes or resizing x and y. Save this as `fct2.jpg`

11. Plot $z = cos(x+y)cos(3x-y) + cos(x-y) * sin(x+3y) + 5e^{((x^2+y^2)/8)}$. Chose nice x and y values to get an "interesting" graph. Save this graph as `interesting_graph.jpg`.

12. Consider the MatLab code that makes another interesting graph. Save the graph in `strange.jpg`.

```
A=randn(50);
surf(A)
shading interp
```