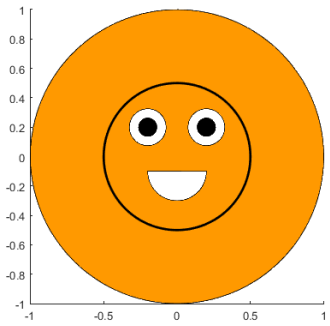
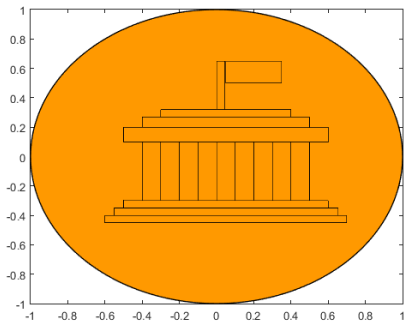
MATLAB Projects

Coin Flip

For this project the students wrote code that simulated the a number of coin flips and averaged the result of heads vs tails. They then displayed that result visually with a drawing of a coin.

Output:





Listing 1: Coin Flip Code

```
headsCounter=0
tailsCounter=0

o=0:.01:6.28;
u=3.14:.01:6.28;

for i = 1:9
        coin=rand;
        if coin>.5
                disp('heads')
                headsCounter=headsCounter+1
        else
                disp('tail')
                tailsCounter=tailsCounter+1
        end
end
```

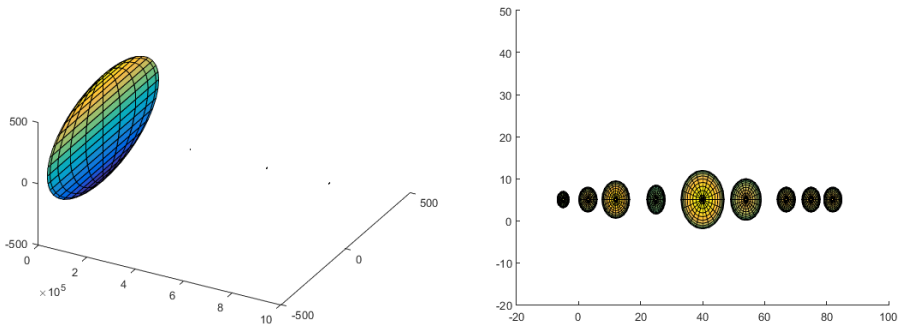
Listing 2: Coin Flip Code Continued

```
if headsCounter>tailsCounter
        hold on
        fill(cos(o),sin(o),[1,.6,0])
        fill(cos(o)/2,sin(o)/2,[1,.6,0],'linewidth',2)
        fill((cos(o)/8)-.2,(sin(o)/8)+.2,'w')
        fill((cos(o)/8)+.2,(sin(o)/8)+.2,'w')
        fill((cos(o)/16)-.2,(sin(o)/16)+.2,'k')
        fill((cos(o)/16)+.2,(sin(o)/16)+.2,'k')
        fill(cos(u)/5,(sin(u)/5)-.1,'w')

        daspect([1,1,1])
        hold off
else
        fill(cos(o),sin(o),[1,.6,0],'linewidth',1)
        rectangle('Position',[-.5,0.1,1.1,0.1])
        rectangle('Position',[-.4,-0.3,0.1,0.4])
        rectangle('Position',[-.2,-0.3,0.1,0.4])
        rectangle('Position',[0,-0.3,0.1,0.4])
        rectangle('Position',[0.2,-0.3,0.1,0.4])
        rectangle('Position',[0.4,-0.3,0.1,0.4])
        rectangle('Position',[-.5,-0.35,1.1,0.05])
        rectangle('Position',[-.55,-0.4,1.2,0.05])
        rectangle('Position',[-.6,-0.45,1.3,0.05])
        rectangle('Position',[-.4,0.2,0.9,0.07])
        rectangle('Position',[-.3,0.27,0.7,0.05])
        rectangle('Position',[0,0.32,0.045,0.33])
        rectangle('Position',[0.05,0.5,0.3,0.15])

        hold off
end
```

Planets

In this project the students created two visualizations of the planets in the universe: one of the first 3 planets to scale and one of all the planets not to scale.

Output:



Listing 3: Planets To Scale Code

```
x=1;
y=1
z=1
hold on
[x,y,z]=sphere;
figure
hold on
surf(432.7*x,432.7*y,432*z)
surf(1.516*x+360234.2,1.516*y,1.516*z)
surf(3.760*x+676764.6,3.760*x,3.760*z)
surf(3.960*x+933966.6,3.960*y,3.960*z)
```

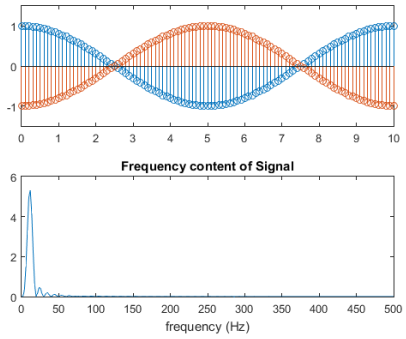
Listing 4: Planets Not To Scale Code

```
x=1;
y=1
z=1

hold on
[x,y,z]=sphere;
figure

hold on
surf(2*x-5,2*y+5,2*z+5)

hold on
surf(4.5*x+12,4.5*y+5,4.5*z+5)

hold on
surf(3*x+3,3*y+5,3*z+5)
surf(7*x+40,7*y+5,5*z+5)
surf(5*x+54,5*y+5,3*z+5)
surf(3*x+25,3.5*y+5,1.5*z+5)
surf(3*x+67,3*y+5,3*z+5)
surf(3*x+75,3*y+5,3*z+5)
surf(3*x+82,3*y+5,3*z+5)
axis([-20 100 -20 50 -10 50])
```

Double Helix

In this project the students modified code they found online to create a 2d visualization of a double helix.

Output:



Listing 5: Double Helix Code

```
n=[0:0.1:10];
F1=100*10^3; %100KHz and t=1*10^-5
Fs=1*10^6; %1MHz
T=1/Fs; %1*10^-6
%Time period = t/T => 10

hold on
xn=cos(2*pi*(F1)*n*T);
subplot(2,1,1),stem(n,xn);
xm=-cos(2*pi*(F1)*n*T);

hold on
subplot(2,1,1),stem(n,xm);
ylim([-1.5 1.5]);
xlim ([0 10]);
```

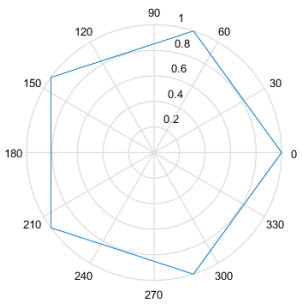
Listing 6: Double Helix Code Continued

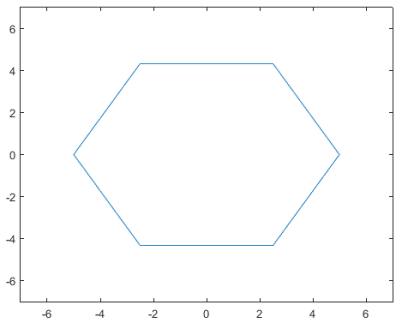
```
grid off;
subplot(2,1,2),fft(xn);
ylim([-1.5 1.5]);
xlim ([0 10]);

grid off;

Y = fft(xn,512);
Pyy = Y.*conj(Y)/512;
f = 1000*(0:256)/512;

plot(f,Pyy(1:257))
title('Frequency content of Signal')

xlabel('frequency (Hz)')

% Code modified from
% http://www.mathworks.com/matlabcentral/answers
% .../49174-fft-of-cosine-wave-in-matlab
```

Polygons

In this project the students wrote two programs draws polygons, taking as input the number of sides the polygon should have.

Output:





Listing 7: Polygons Code

```
n= input('how many sides')
theta= 0:(2*pi)/n:2*pi
r=ones (1, (n+1))
polar(theta,r)
```

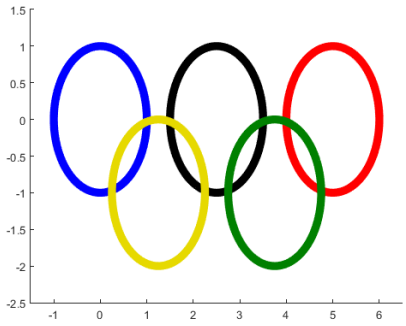
Listing 8: Coin Flip Code

```
n=input('Enter a number n that will...
          result in an n-side polygon')
r= input ('Enter a number radius')
x=0:(2*pi)/n:2*pi;
plot(r*cos(x),r*sin(x))
axis ([-(r+2),(r+2),-(r+2),(r+2)])
```

Olympic Rings

In this project the students wrote a program that draws the Olympic rings. It is contained in a for loop that will draw the rings many times at different sizes.

Output:



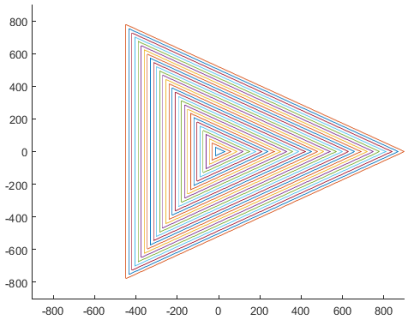
Listing 9: Olympic Rings Code

```
for i=0:1
        t=0:0.01:6.28
        hold on
        plot(i*cos(t), i*sin(t),'b','linewidth',7)
        plot(i*cos(t)+2.5, i*sin(t),'k','linewidth',7)
        plot(i*cos(t)+5, i*sin(t),'r','linewidth',7)
        plot(i*cos(t)+1.25, i*sin(t)-1,'color',...
                [.9 .85 0],'linewidth',7)
        plot(i*cos(t)+3.75, i*sin(t)-1,'color',...
                [0 .5 0],'linewidth',7)
        hold off
        axis([-1.5, 6.5, -2.5, 1.5])
end
```

Multiple Triangles

In this project, the students wrote a program that draws a number of concentric triangles specified by the user.

Output:



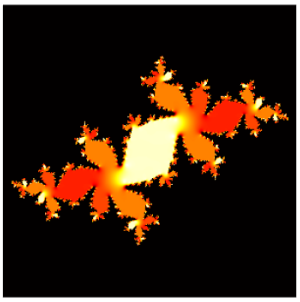
Listing 10: Multi-Polygon Code

```
r=input ('what is the radius: ')
n=input ('How many triangles: ')
theta= 0:2*pi/3:2*pi;
for i=1:n
        rad=r*i
        hold on
        plot ([rad*cos(theta)],[rad*sin(theta)])
        axis ([-(rad+1),(rad+1),-(rad+1),(rad+1)])
end
hold off
```

Julia Sets

In this project, the student modified code that was found line to explore Julia sets for different parameters.

Output:



Listing 11: Julia Set Code

```
col=30;
m=300;
cx=0;
cy=0;
l=1.5;
x=linspace(cx-l,cx+l,m);
y=linspace(cy-l,cy+l,m);
[X,Y]=meshgrid(x,y);
c= -0.488679-0.56790*i;
Z=X+i*Y;
for k=1:col;
Z=Z.^1000+c;
W=exp(-abs(Z));
end
colormap winter(256)
pcolor(W);
shading flat;
axis('square','equal','off');

% Julia_GUI
% by Gentian Zavalani
% 26 Apr 2014 (Updated 28 Apr 2014)
```

Letter Grade Calculator

In this project, the students wrote a program taht takes user input in the form of a numerical grade and prints it's letter grade (out of 100 possible points).

Output:

```
Enter your average: 74
grade is C
```

Listing 12: Letter Grade Code

```
avg= input('Enter␣your␣average:␣')

if avg >= 91
        grade='A';
        disp('grade␣is␣A')
elseif avg >= 81
        grade='B';
        disp('grade␣is␣B')
elseif avg >= 71
        grade='C';
        disp('grade␣is␣C')
elseif avg >= 61
        grade='D';
        disp('grade␣is␣D')
elseif avg <= 60
        grade='F';
        disp('grade␣is␣F')
end
```