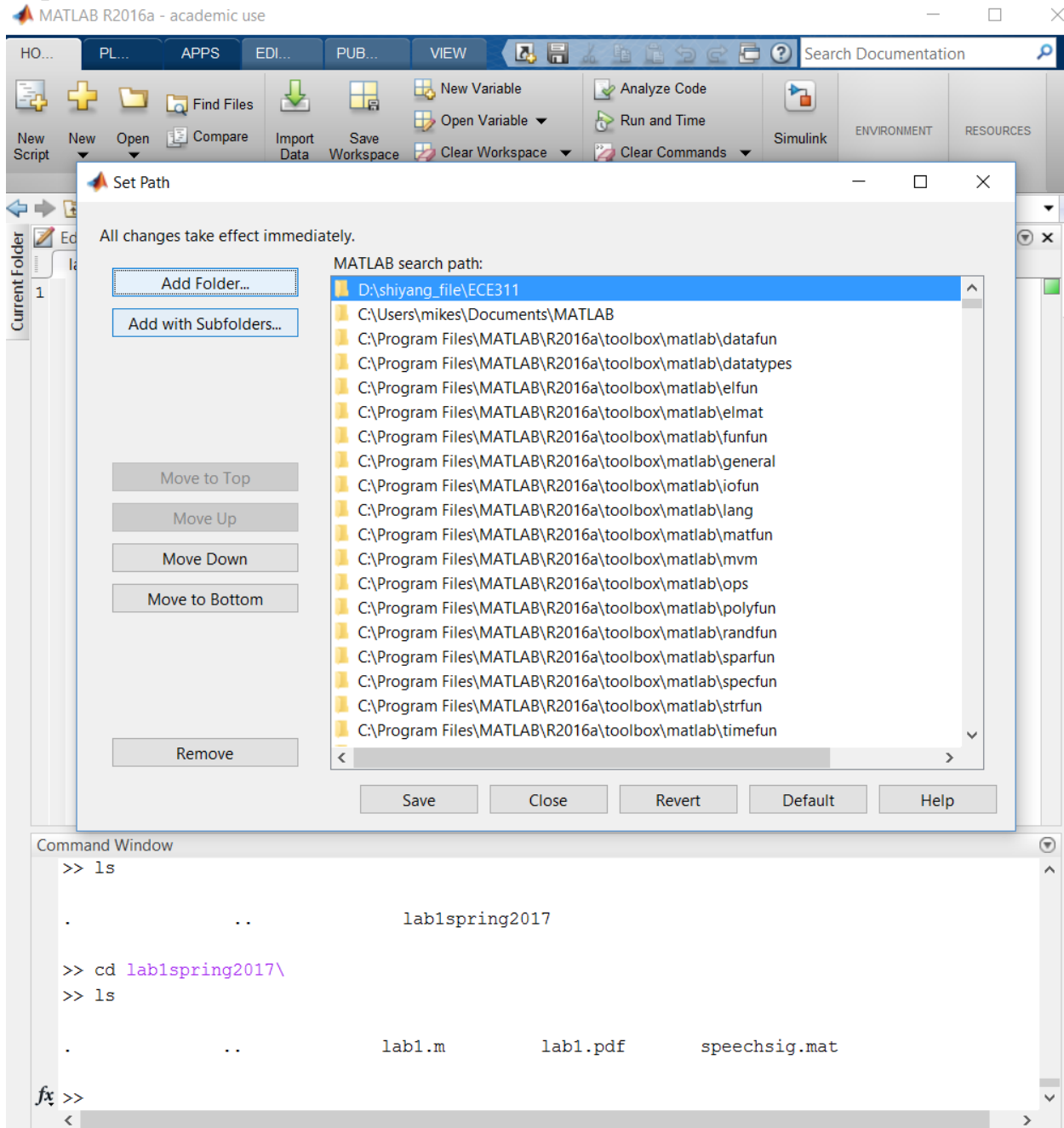ECE 311

Lab1 report

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Report Item 1:

Report Item 2:

Code part:

```
%report_item_2
q2 = linspace(0,1,12);
```

Explanation:

Gap between two consecutive points is (1-0)/(12-1) = 0.0909
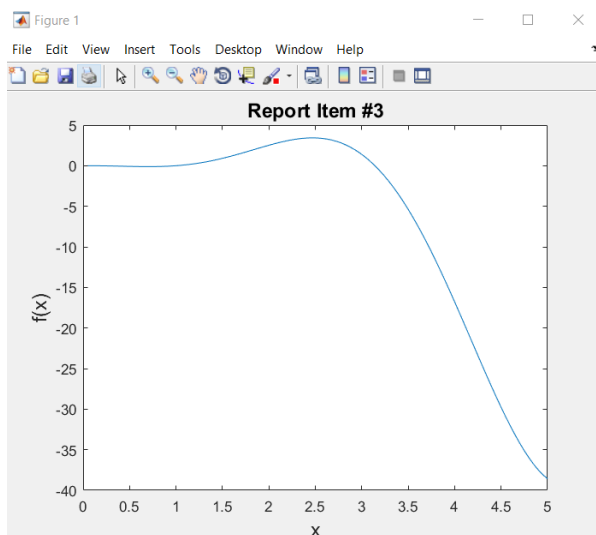
General formula: (b-a)/(N-1)

Report Item 3:

Code part:

```
%report_item_3
x1 = linspace(0,5,100);
y = x1.^2.*log(x1).*sin(x1);
figure(1);
plot(x1,y);
xlabel('x','fontsize',14);
ylabel('f(x)','fontsize',14);
title('Report Item #3','fontsize',14);
```

Explanation:

Plot:

Report Item 4:

Code part:

```matlab
%report_item_4
x2 = 0:0.2:5;
sq = sqrt(x2);
fx = x2.^2.*exp(sq);
g = 3.*sq + sin(8*pi*x2);
figure(2);
subplot(2,1,1);
plot(x2,fx);
xlabel('x','fontsize',14);
ylabel('f(x)','fontsize',14);
title('Report Item #4_plot plot1','fontsize',14);
subplot(2,1,2);
plot(x2,g);
xlabel('x','fontsize',14);
ylabel('g(x)','fontsize',14);
title('Report Item #4_plot plot2','fontsize',14);

figure(3);
subplot(2,1,1);
stem(x2,fx);
xlabel('x','fontsize',14);
ylabel('f(x)','fontsize',14);
title('Report Item #4_stem plot1','fontsize',14);
subplot(2,1,2);
stem(x2,g);
xlabel('x','fontsize',14);
ylabel('g(x)','fontsize',14);
title('Report Item #4_stem plot2','fontsize',14);
```

Explanation:
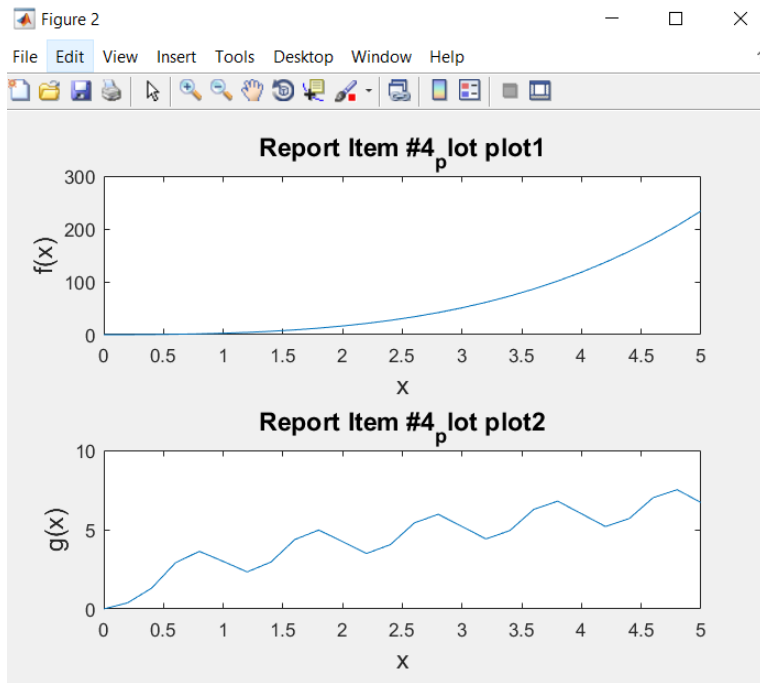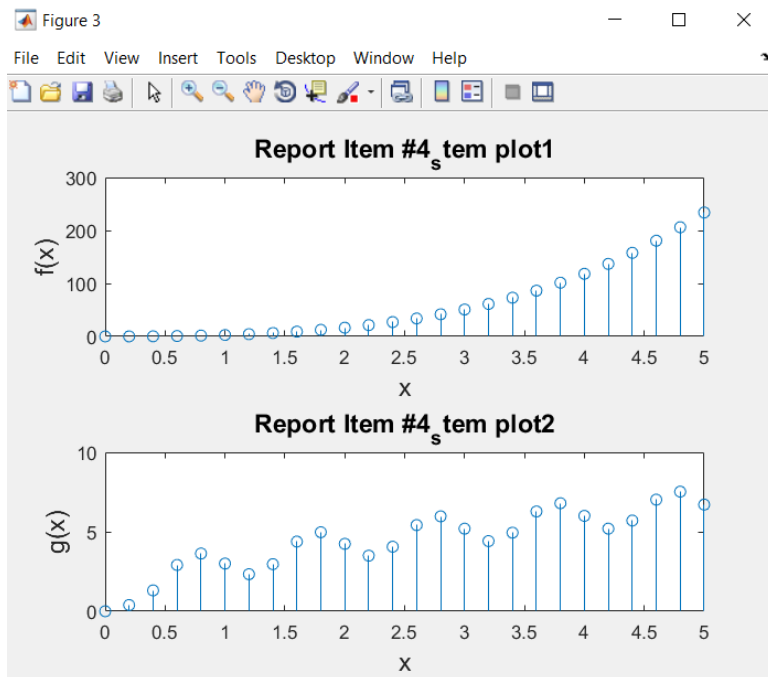
Figure 2 is using plot function:


Figure 3 is using stem function:

Report Item 5:

Code part:

```matlab
%%
%report_item_5
x5 = linspace(-5, 5, 400);
y5 = linspace(-4, 4, 300);
[xx,yy] = meshgrid(x5, y5);
f = sinc(sqrt(xx.^2+yy.^2));
imagesc(x5,y5,f);
xlabel('x','fontsize',14);
ylabel('y','fontsize',14);
title('Report Item #5.1 f(x, y)','fontsize',14);
axis xy;
%%
x52 = linspace(-5, 5, 400);
y52 = linspace(-4, 4, 300);
[xxx,yyy] = meshgrid(x5, y5);
f2 = sinc(xxx).*sinc(yyy);
imagesc(x52,y52,f2);
xlabel('x','fontsize',14);
ylabel('y','fontsize',14);
title('Report Item #5.2 f(x, y)','fontsize',14);
axis xy;
```

Explanation:

Plot 1 is for the function: $f = \text{sinc}(\text{sqrt}(x^2+y^2))$
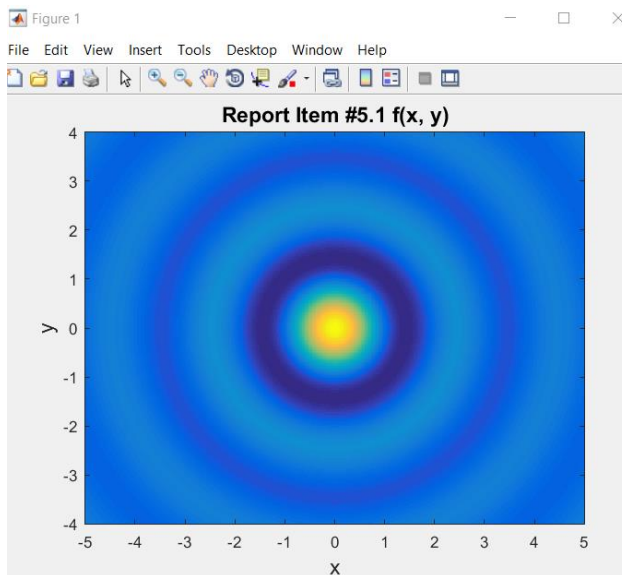
Plot 2 is for the function: f = sinc(x)*sinc(y)
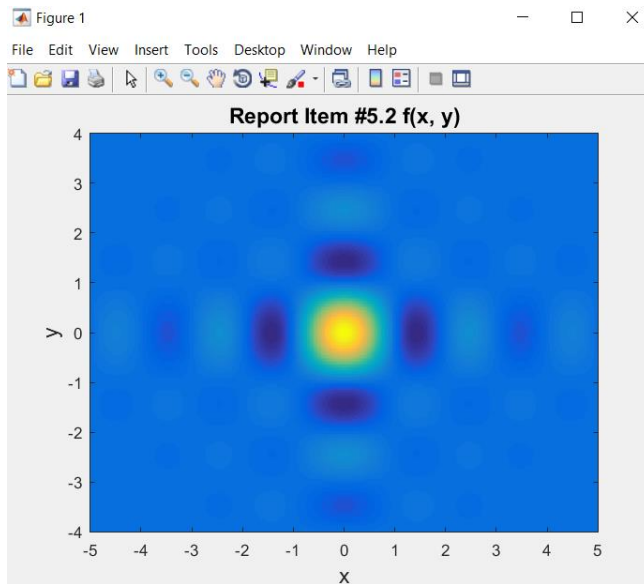
Report Item 6:

Code part:

```
function [Xk] = myDFT(x)
[M,N] = size(x);
Xk = zeros(1, N);
for k = 0 : (N-1)
    for j = 0 : (N-1)
        Xk(1, k+1) = Xk(1, k+1) + x(j+1)*exp(-1i*2*pi*k*j/N);
    end
end
Y = fft(x);
Xreal = real(Xk);
Ximag = imag(Xk);
Yreal = real(Y);
Yimag = imag(Y);

figure(1);
stem(Xreal);
hold on
stem(Ximag);
xlabel('k','fontsize',14);
ylabel('X(k)','fontsize',14);
legend('Real part','Imaginary part');
title('myDFT result');
```
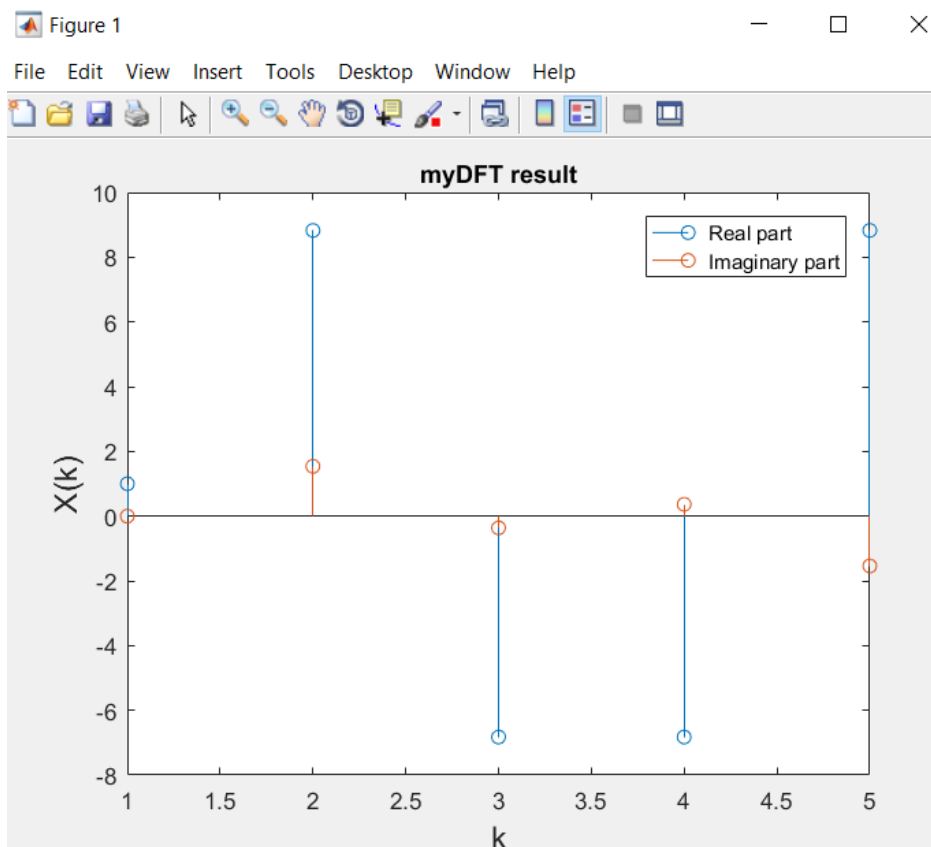
```
figure(2);
stem(Yreal);
hold on;
stem(Yimag);
xlabel('k','fontsize',14);
ylabel('X(k)','fontsize',14);
title('built-in fft function result');
legend('Real part','Imaginary part');
end
```
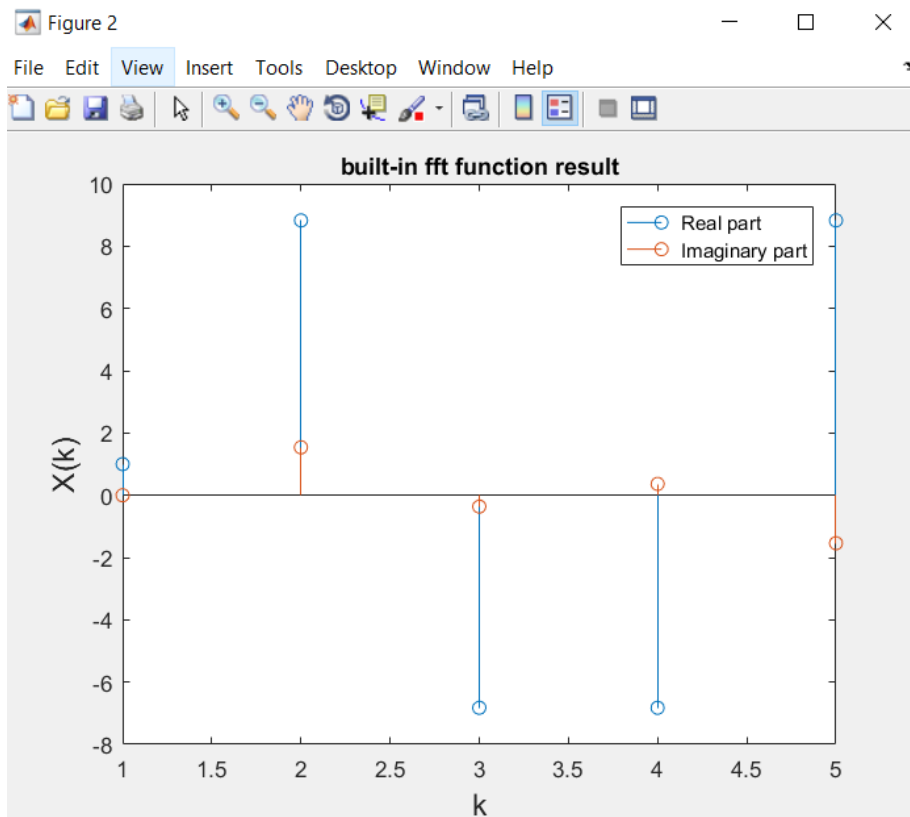
Explanation:
The figure 1 is the plot for the DFT of x = [1, 3, -4, -3, 4] using my own
implemented function. And it contains the output using stem function.

The figure 2 is the plot for the DFT of x = [1, 3, -4, -3, 4] using MATLAB's build-
in fft function. And it contains the output using stem function.

built-in fft function result

Since these two plots are exactly the same, the result of my DFT function ought to be correct.

Report Item 7:

Code part:

```
%report_item_7
soundsc(x, 10000);
```

Explanation:

I loaded the speechsig.mat into MATLAB and play the sound using sampling frequency 10000Hz. The sentence is 'Line up'. The frequency range of human hearing is: 20 to 20000Hz according to Wikipedia.

Reference: https://en.wikipedia.org/wiki/Hearing_range

Report Item 8:

Code part:

```
%report_item_8
load('clown');
figure(1);
colormap(map);
imagesc(X);
xlabel('pixel_x','fontsize',14);
ylabel('pixel_y','fontsize',14);
title('Clown picture','fontsize',14);

figure(2);
colormap(map);
subplot(2,1,1);
plot(X(:, 17));
xlabel('pixel number','fontsize',14);
ylabel('grey value','fontsize',14);
title('17th row column value','fontsize',14);
subplot(2,1,2);
plot(X(49, :));
xlabel('pixel number','fontsize',14);
ylabel('grey value','fontsize',14);
title('49th column value','fontsize',14);

Xt = X';
figure(3);
colormap(map);
imagesc(Xt);
xlabel('pixel_x','fontsize',14);
ylabel('pixel_y','fontsize',14);
title('Transposed clown picture','fontsize',14);
```
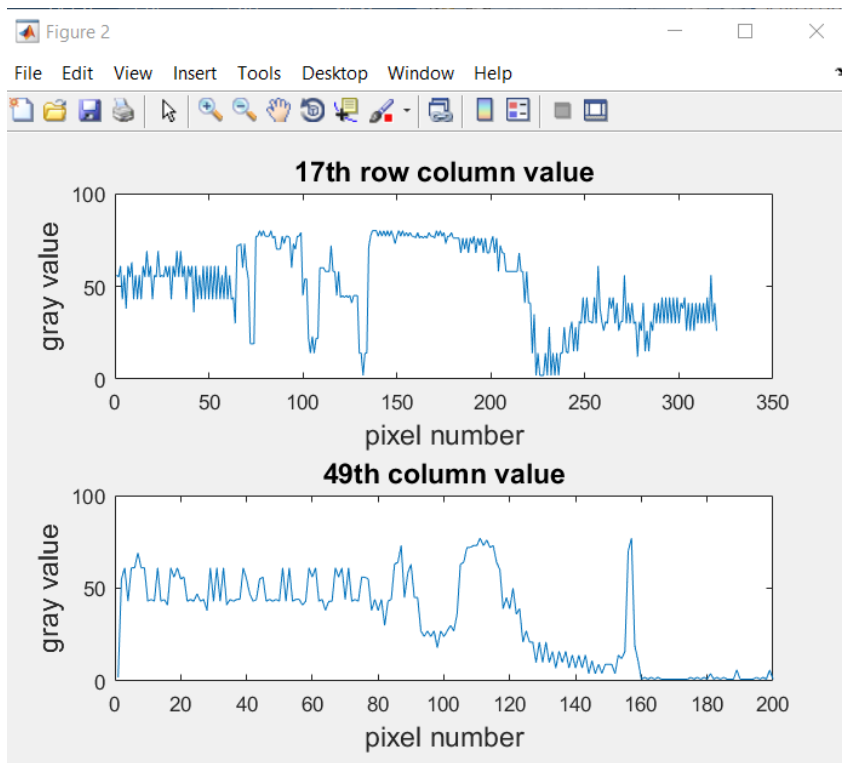
Explanation:

The first image is the clown picture loaded from the MATLAB library.
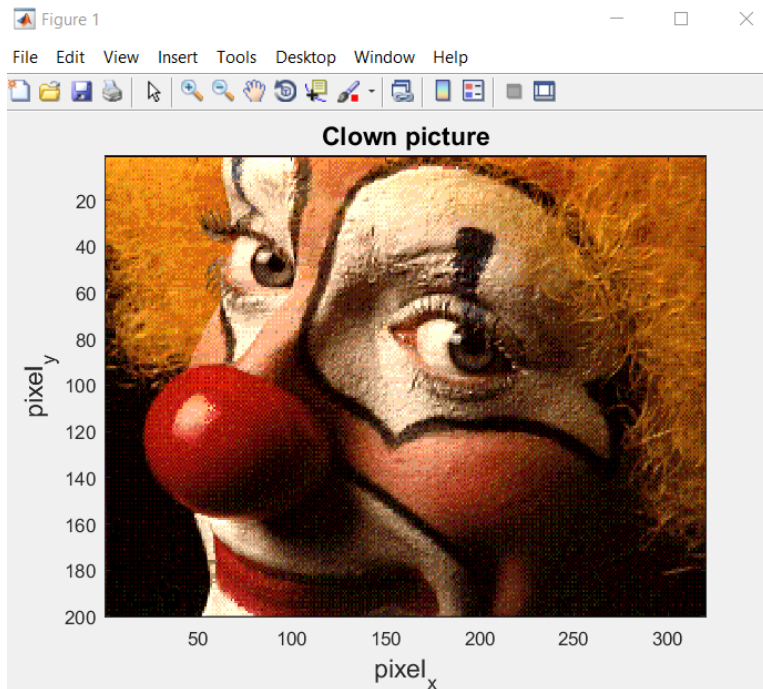
The second plot includes the plot of 17th row and 49th column gray value of that picture.

The third image is the transposed clown picture.

Transposed clown picture