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Department of Electrical, Computer, & Biomedical Engineering
Faculty of Engineering & Architectural Science

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Instructor:	**Dimitri Androutsos**

Assignment/Lab Number:	**1**
Assignment/Lab Title:	Working with MATLAB, Visualization of Signals

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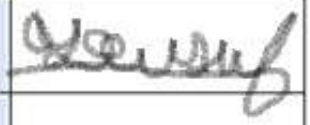
Yousuf	**Syed**	500833920	3	

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Lab 1: Working with MATLAB, Visualization of Signals

By: Syed Yousuf and Khaled Hashem

A.

A.1:

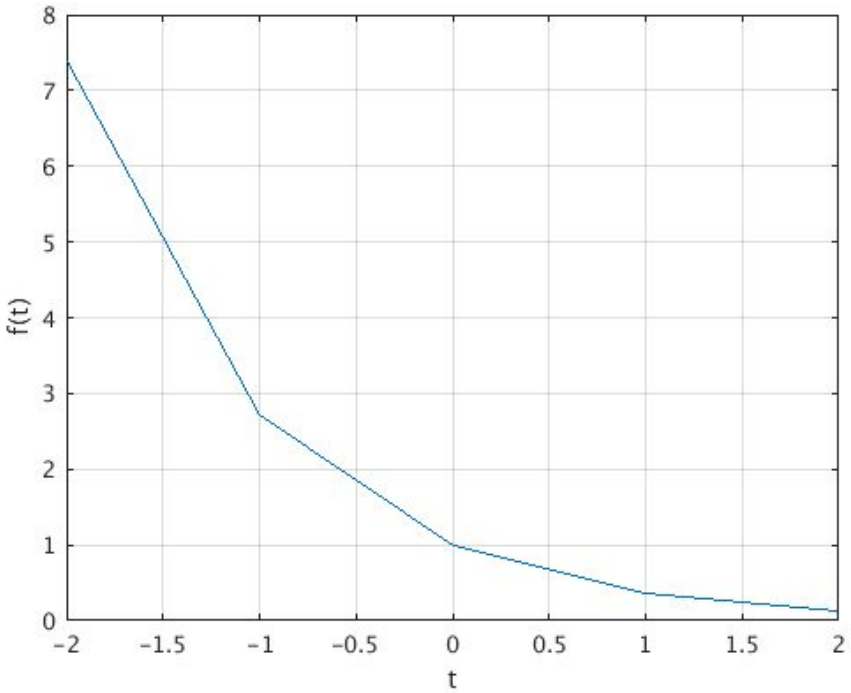
Mathlab code for generating and plotting graph 1.46:

```
% Set the value of t
t = (-2:2);

% Create function
f = @(t) exp(-t).*cos(2*pi*t);

plot(t,f(t));
xlabel('t');
ylabel('f(t)');
Grid;
```

Graph 1.46



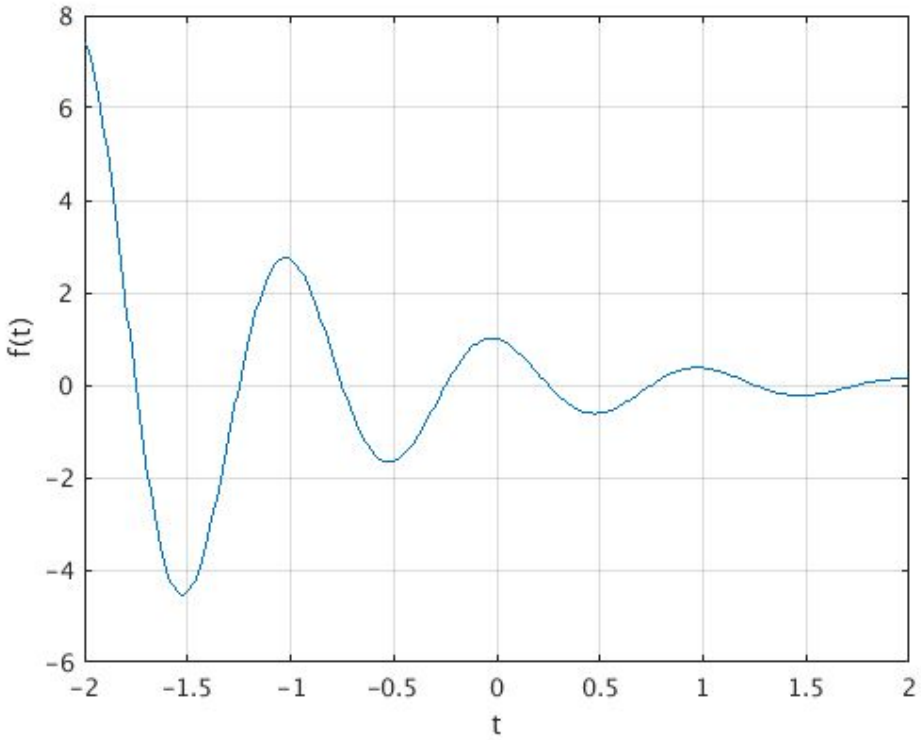
Mathlab code for generating and plotting graph 1.47:

```
% Set the value of t
t = (-2:0.01:2);

% Create function
f = @(t) exp(-t).*cos(2*pi*t);

plot(t,f(t));
xlabel('t');
ylabel('f(t)');
grid;
```

Graph 1.47



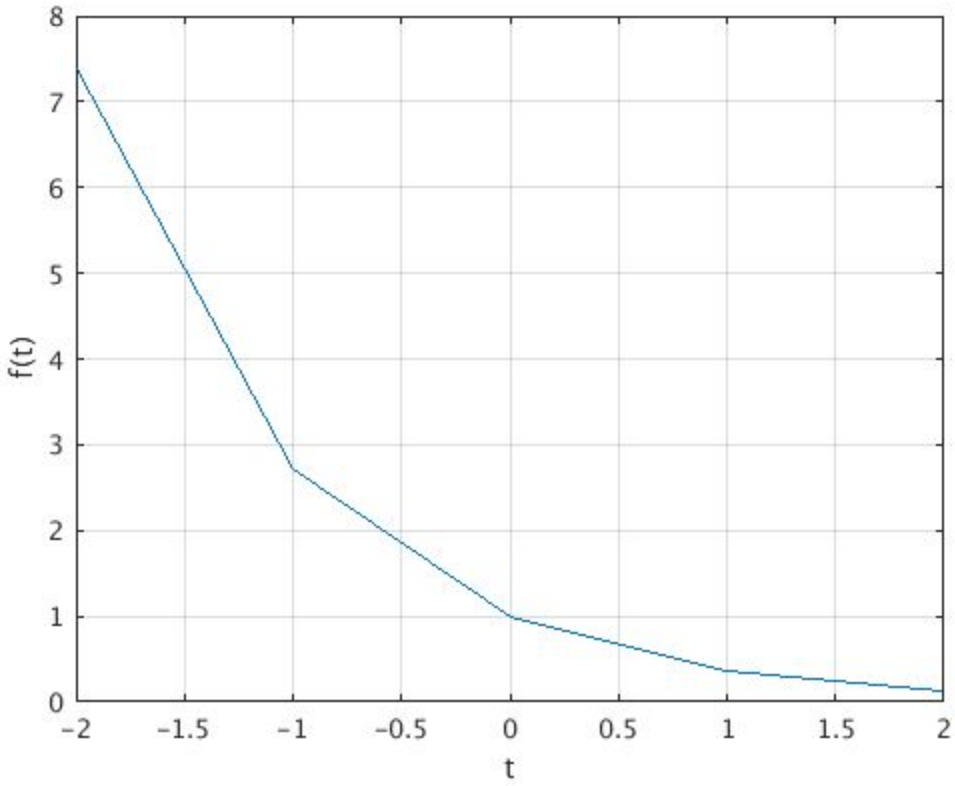
A.2:

Matlab code

```
% Set the value of t
t = (-2:2);

% Create function
f = @(t) exp(-t);

plot(t,f(t));
xlabel('t');
ylabel('f(t)');
grid;
```



A3:

When the graph for question A.2 with graph 1.46, we observe the following. We observe that both graphs are identical. Thus, f1 = @(t) exp(-t) produces the same graph as f2 = @(t) exp(-t).*cos(2*pi*t). Additionally, all the graphs decrease exponentially. The jagged edges we observe in graph1.46 and question A.2 is due to the large step size that was set for these two graphs.

B.

B1.:

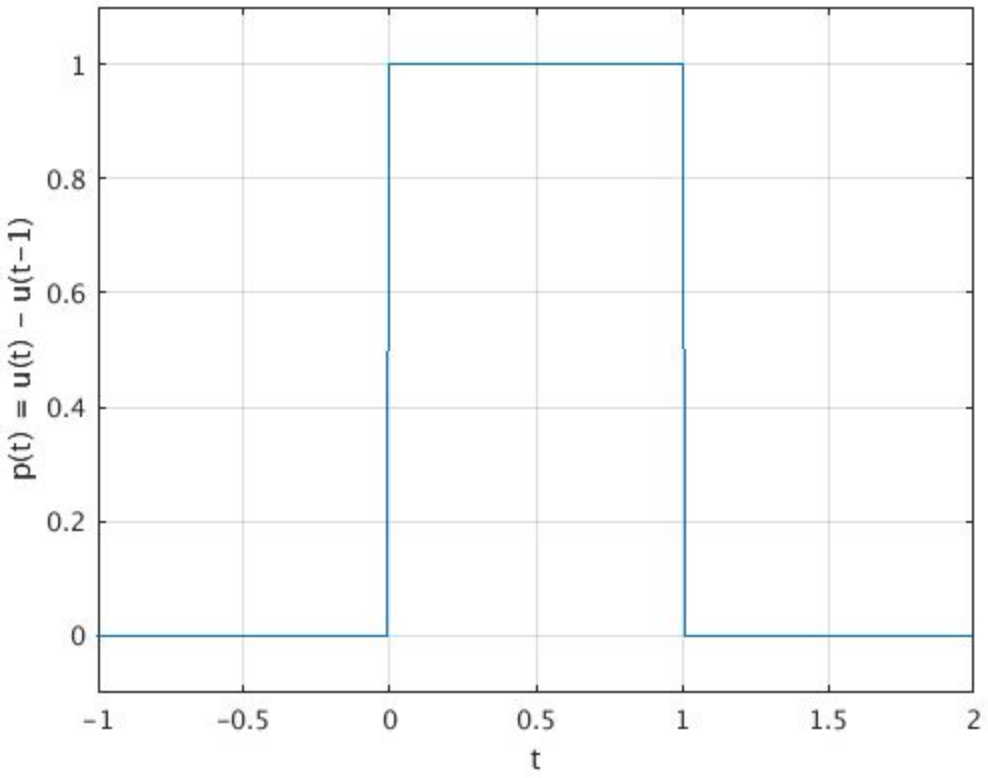
Matlab code:

```
% Set the value of t
t = (-2:0.01:2);

% Create function
p = @(t) 1.0 * ((t >= 0) & (t <= 1));

plot(t,p(t));
xlabel('t');
ylabel('p(t) = u(t) - u(t-1)');
axis([-1 2 -0.1 1.1]);

grid;
```



B.2:

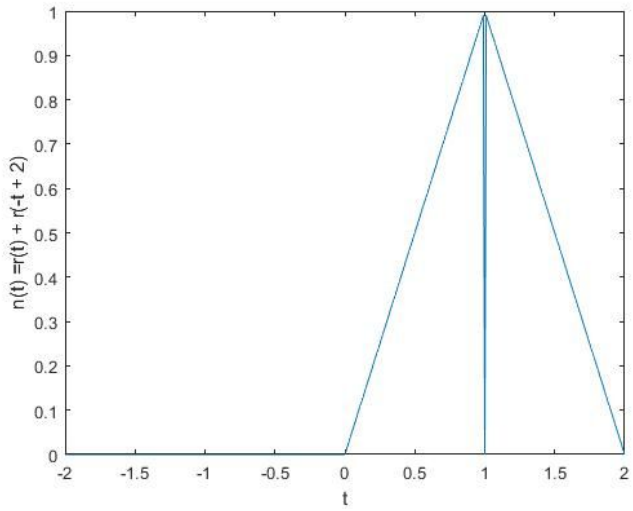
Matlab code for r(t)

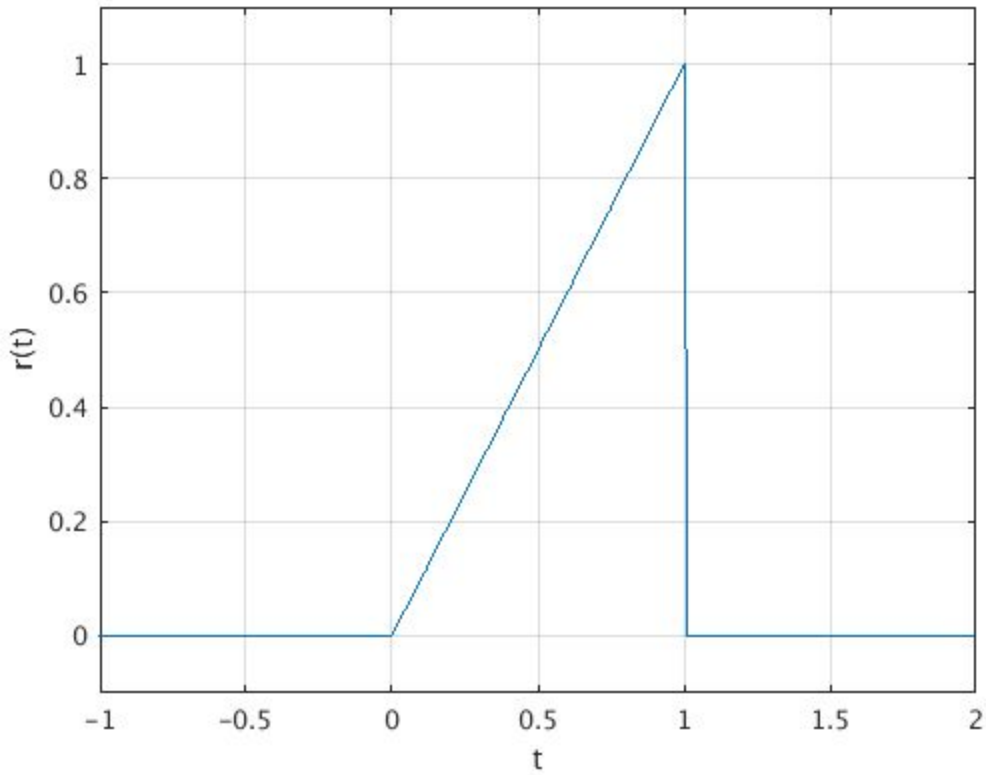
```
% Set the value of t
t = (-2:0.01:2);

% Create function
u=@(t) 1.0.*(t>=0);
p=@(t) u(t)-u(t-1);
r = @(t) t.*p(t);
n = @(t) r(t) + r(-t + 2);


plot(t,r(t));
xlabel('t');
ylabel('r(t) = t*p(t)');
axis([-1 2 -0.1 1.1]);
grid;
```

```
plot(t, n(t));
xlabel("t");
ylabel("n(t) =r(t) + r(-t + 2)");
```





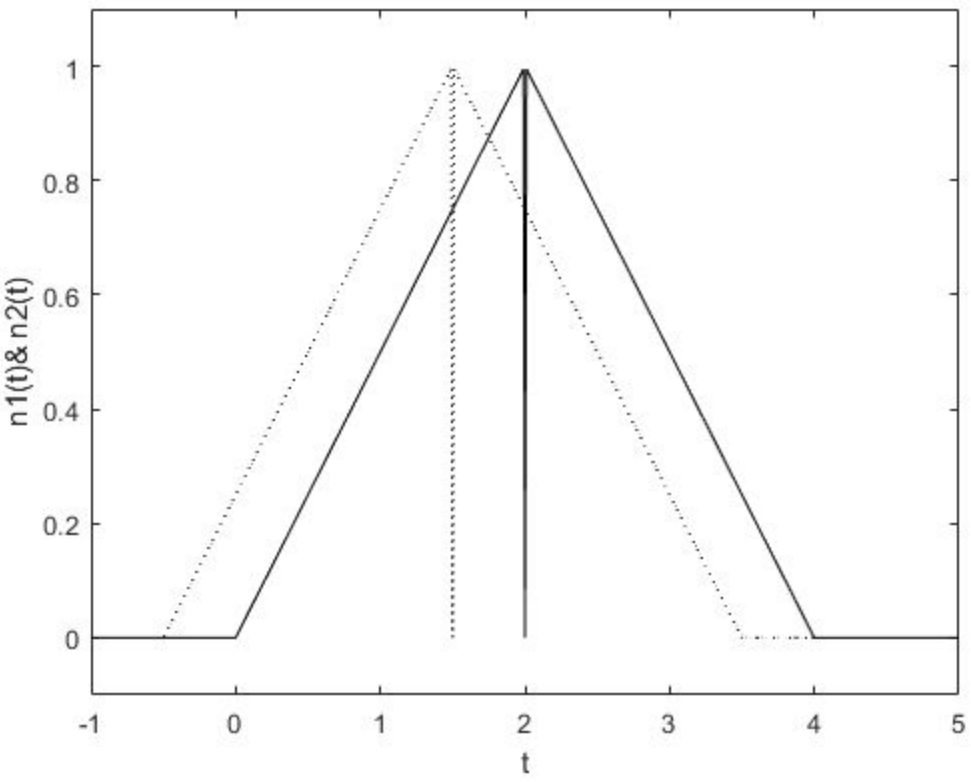
B.3:

Matlab code

```
u = @(t) 1.0.*(t>=0);
p = @(t) u(t)-u(t-1);
r = @(t) (t.*p(t));

n = @(t) r(t)+r(-t+2);
n1 = @(t) n(0.5.*t);
n2 = @(t) n1(t+0.5);

n3 = @(t) n(t+0.25);
n4 = @(t) n3(0.5.*t);
t = (-1: 0.01:5); plot(t,n3(t),'-k',t,n4(t),':k');
xlabel('t'); ylabel('n3(t)& n4(t)');
axis([-1 5 -.1 1.1]);
grid;
```



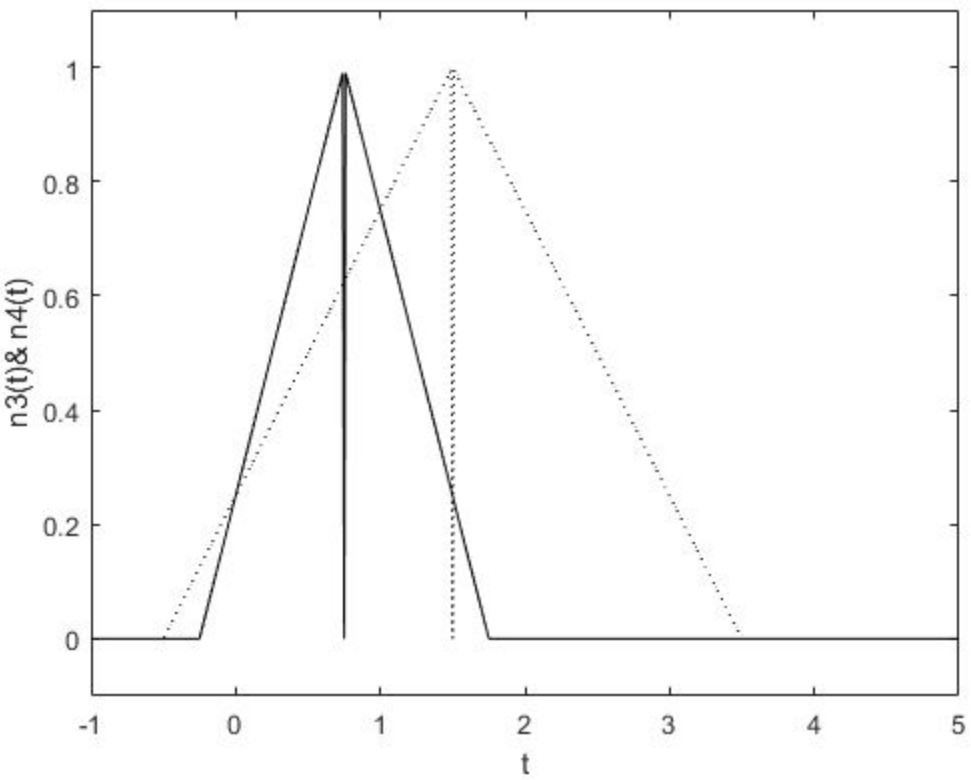
B.4:

Matlab code:

```
u = @(t) 1.0.*(t>=0);
p = @(t) u(t)-u(t-1);
r = @(t) (t.*p(t));

n = @(t) r(t)+r(-t+2);
n1 = @(t) n(0.5.*t);
n2 = @(t) n1(t+0.5);
t = (-1: 0.01:5); plot(t,n1(t),'-k',t,n2(t),':k');
xlabel('t'); ylabel('n1(t)& n2(t)');
axis([-1 5 -.1 1.1]);

grid;
```



B.5:

When we compare n4(t) and n2(t), we observe that both of them produce the exact same graph.

C:

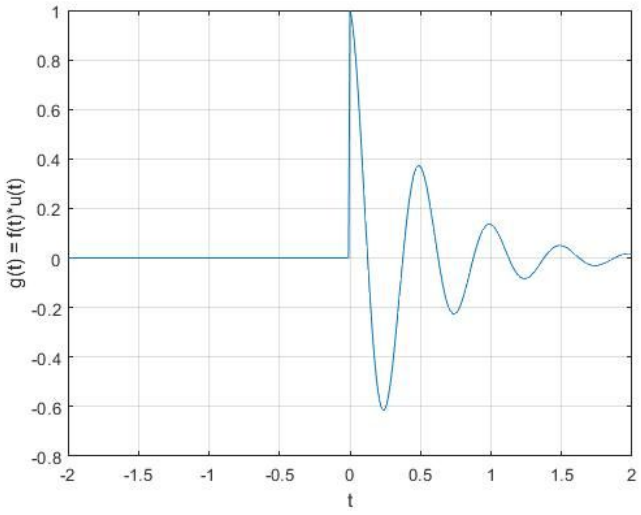
C.1:

Matlab:

```
% Create f(t) function
f = @(t) exp(-2.*t).*cos(4*pi*t);
t = (-2:0.01:2);

% Create u(t) function
u = @(t) 1.0.*(t>=0);
axis([-2 2 -0.1 1.1]);

% Create a g(t) function
g = @(t) f(t).*u(t);
t = (-2:0.01:2);
plot(t,g(t));
xlabel("t");
ylabel("g(t) = f(t)*u(t)");
grid();
```



C.2:

Matlab:

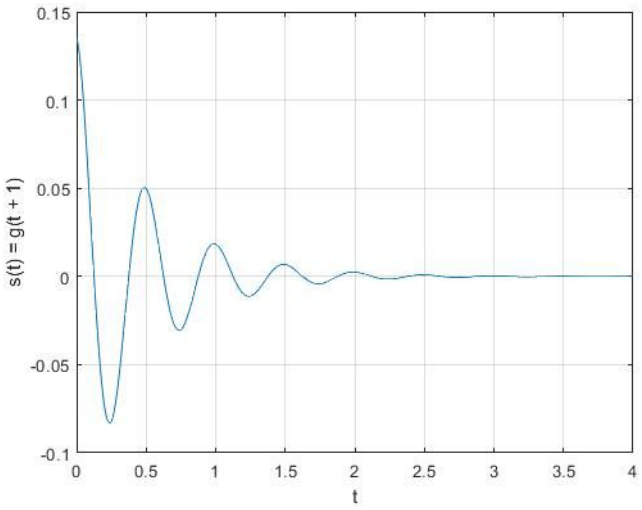
```
% Create f(t) function
f = @(t) exp(-2.*t).*cos(4*pi*t);
t = (-2:0.01:2);

% Create u(t) function
u = @(t) 1.0.*(t>=0);
axis([-2 2 -0.1 1.1]);

% Create a g(t) function
g = @(t) f(t).*u(t);
t = (-2:0.01:2);

% Create the s(t) function
s = @(t) g(t + 1);
t = (0: 0.01: 4);

%plot
plot(t,s(t));
xlabel("t");
ylabel("s(t) = g(t + 1)");
grid();
```



C.3:

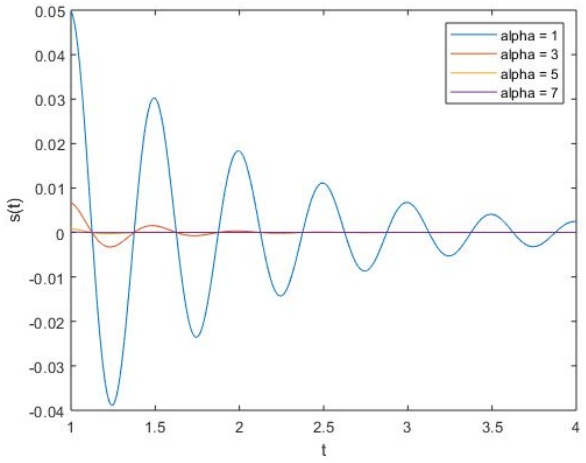
Matlab:

```
% Create u(t) function
u = @(t) 1.0.*(t>=0);
t = (1 :0.01: 4);
matrix = zeros(401, 4);

for alpha = 1:2:7
    %Create each function.
    s = @(t) exp(-2).*exp(-alpha.*t).*cos(4*pi*t).*u(t);
    plot(t,s(t));
    xlabel("t");
    ylabel("s(t)");

    %Make sure to hold off plotting it on the figure.
    hold on;
end

%Create the legend
legend('alpha = 1', 'alpha = 3', 'alpha = 5', 'alpha = 7');
%Plot all the functions on one figure.
hold off;
```



C.4:

The size of the array generated in C.3 for s(t) is 1604.

D

D.1

a) Operation lists the components of the matrix array vertically, starting from the leftmost column.
b) Elements at row 2 (column 1), row 4 (column 1) , and at row 2 (column 2), which is technically the 7th element, are all listed when this operation is performed.
c) Creates a logical matrix array (5 x 4) , that has values 0 and 1, the position in which the matrix has 0 refers to the part of the original matrix array A where the value of the element is not greater than or equal to 0.2, and the opposite holds if this generated logical matrix array holds 1 at parts of its indexes.
d) This operation , on the other hand, lists the elements that are greater than or equal to 0.2 in array A.
e) This operation places zeros at the indexes of A where the elements are greater than or equal to 0.2.

D.2

a)

```
load('ELE532_Lab1_Data.mat')
num_rows = size(B,1);
num_cols = size(B,2);

for i=1:1:num_rows
      for j=1:1:num_cols
            if (abs(B(i,j)) < 0.01)
                        B(i,j)=0;
            end
      end
end
```

b)

```
load('ELE532_Lab1_Data.mat')
B([ abs(B) >= 0.01]) = 0
```

c) i)

```
tic
load('ELE532_Lab1_Data.mat')
num_rows = size(B,1);
num_cols = size(B,2);

for i=1:1:num_rows
      for j=1:1:num_cols
            if (abs(B(i,j)) < 0.01)
                  B(i,j)=0;
            end
      end
end

fprintf('\nD2:\nFor part a:\n')
toc
```

ii)

```
tic
load('ELE532_Lab1_Data.mat');
B([ abs(B) >= 0.01]) = 0

fprintf('\nD2: \nFor part b: Elapsed time is :\n ');
toc

D.3:
% Load the data.
load('ELE532_Lab1_Data.mat');

% Copy the data array x_audio into audio.
audio = x_audio;

num_rows = size(audio,1);
num_cols = size(audio, 2);

number_of_zeros = 0;

for i = 1: num_rows
      for j = 1: num_cols
      if(abs(audio(i,j) == 0))
            number_of_zeros = number_of_zeros + 1;
```

```
      end
      end
end

% How many elements are zero in the
fprintf("\n" + number_of_zeros);

% Now play the sound.
sound(audio,8000)
```