Assignment 5
Juan Silva
ECE 309
Feb. 28, 2018

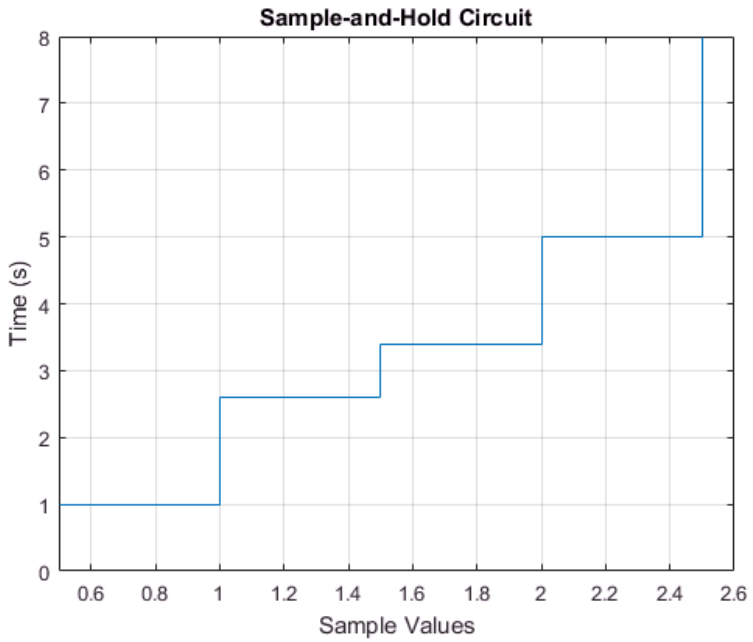
Problem Set 8

Problem Set 8-1:

Generate a plot for the signal that is the output of a sample-and-hold circuit, if the samples values: {1, 2.6, 3.4, 5, 8} were taken at fs = ½ sample/sec., starting at t = 0 sec.

```
fs = [0.5:0.5:2.5];
values = [1 2.6 3.4 5 8];
stairs(fs,values)
axis([0.499 2.6 0 8])
grid
title('Sample-and-Hold Circuit')
xlabel('Sample Values')
ylabel('Time (s)')
```

Results

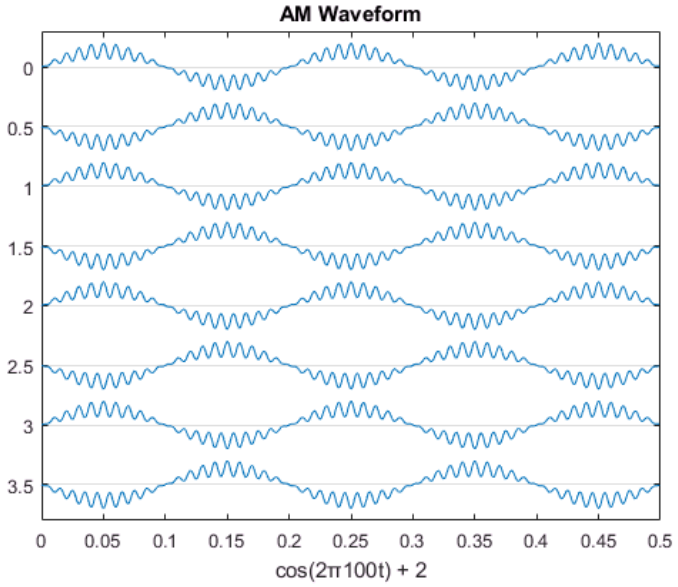


Problem Set 8-2:

Use a strip plot to generate 4 seconds worth of data (starting at t = 0), where each "strip" is .5 seconds worth of data, for the AM signal: s(t) { cos(2pπ100t) + 2} if s(t) is the message signal: s(t) = sin(10πt).

```
fs = 1000;                                          %sample
ts = 1/fs;                                          %time value
t = [0:ts:4];                                       %4 seconds of time values
message = sin(10*pi*t);                             %message frequency
signalFreq = message .* (cos(2*pi*100*t) + 2);      %signal frequency
strips(signalFreq, .5, fs);                         %plot strip
title('AM Waveform')
xlabel('cos(2π100t) + 2')
```

Results



Problem Set 8-3:

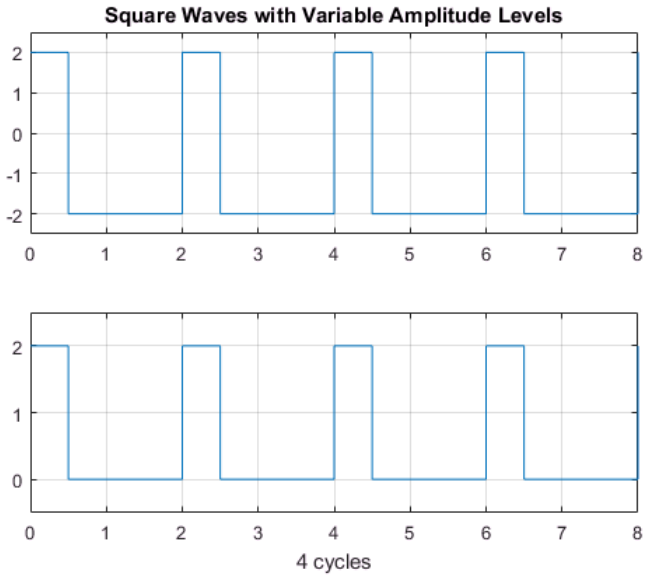
% 3a. Plot 4 cycles of the square wave with amplitude levels {+2, -2},
% period T = 2 sec., and duty cycle 25% (for the "high" value).
% (Choose a reasonable value for fs.)

```
fs = 1000;    % sample
ts = 1/fs;    % sampe time
T = 2;        % two seconds
f = 1/T;      % frequency
amp = 2;      % amplitude
t = 0:ts:8;   % time in seconds (4 cycles * 2 seconds)
D = 25;       % duty percent
subplot(2,1,1)
sqw = amp .* square(2*pi.*f.*t, D);
plot(t,sqw);
ylim([-2.5 2.5])
grid
title('Square Waves with Variable Amplitude Levels')
```

```
% 3b. Repeat problem 3a, but change the amplitude levels to {0, 2}.
```

```
subplot(2,1,2)
sqw2 = (sqw + 2) / 2;
plot(t,sqw2);
ylim([-0.5 2.5])
grid
xlabel('4 cycles')
figure
```

Results

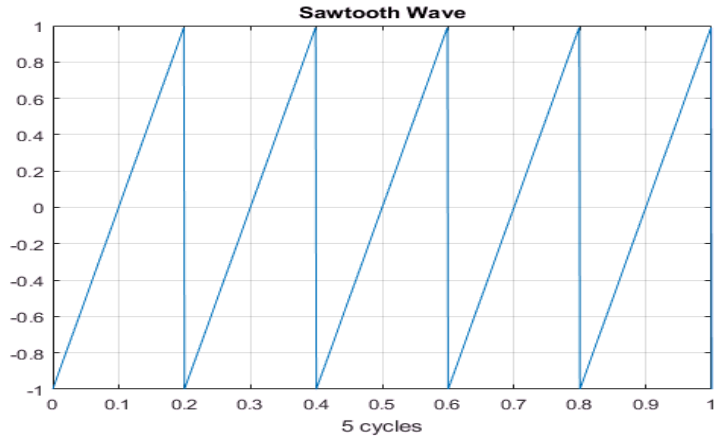


Problem Set 8-4:

Plot 5 cycles of a triangular (sawtooth) wave, where the peak is at the end of the cycle, and the period is T = .2 sec. (Choose a reasonable value for fs.)

```
fs = 1000;
ts = 1/fs;
T = 0.2;
f = 1/T;
t = 0:ts:1;
k = 1;        %default value
saw = sawtooth(2*pi*f.*t, k);
plot(t,saw);
grid
title('Sawtooth Wave')
xlabel('5 cycles')
figure
```

Results



Problem Set 8-5:

Use MATLAB's repmat function to plot a discrete sequence with 6 repetitions of: {0, 1, 2, 3, 4}, starting at n = 0.

```
A = [0:4]
B = repmat(A,1,6)
```

Results

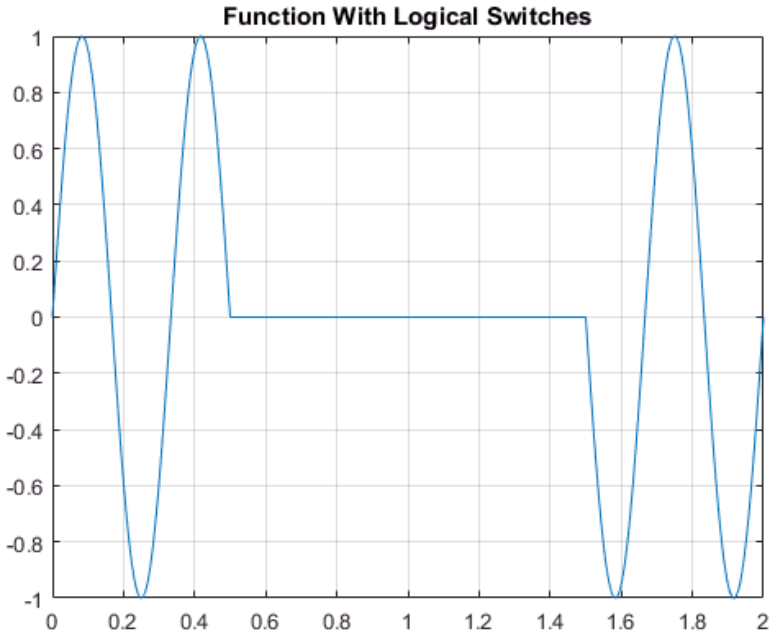
```
A =
     0     1     2     3     4

B =
     0     1     2     3     4     0     1     2     3     4     0     1
     2     3     4     0     1     2     3     4     0     1     2     3
     4     0     1     2     3     4
```

Problem Set 8-6:

Use logical switches to plot the function shown:

```
fs = 8192;
ts = 1/fs;
t = 0:ts:2;
sw1 = (t < 0.5);
sw2 = (t >= 0.5) & (t < 1.5);
sw3 = (t >= 1.5);
x = sw1 .* sin(6*pi.*t) + sw2 * 0 + sw3 .* sin(6*pi.*t);
plot(t,x)
grid
title('Function With Logical Switches')
```

Results



Problem Set 8-7:

Consider the matrix pascal(6). Make a 2-column table showing the row and column for all entries in this matrix that are greater than 50. Hint: Type: >> help pascal, and >> help find.

```
A = pascal(6)
[row, column] = find(A > 50);
display('   row      column')
display([row, column])
```

Results

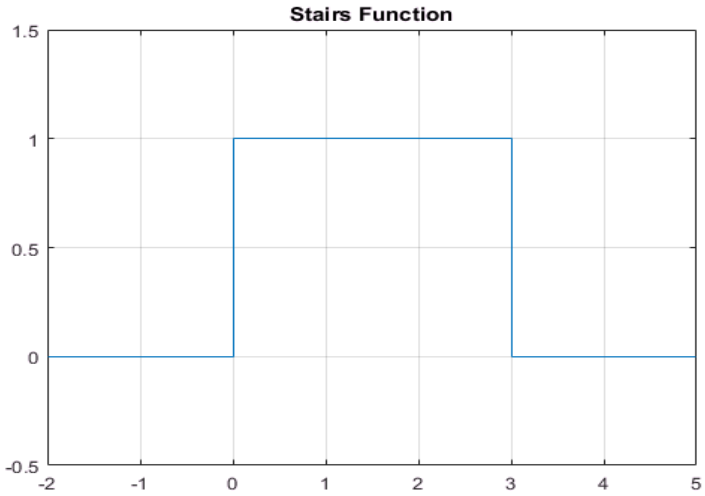
```
A =
     1     1     1     1     1     1
     1     2     3     4     5     6
     1     3     6    10    15    21
     1     4    10    20    35    56
     1     5    15    35    70   126
     1     6    21    56   126   252

row         column
     6     4
     5     5
     6     5
     4     6
     5     6
     6     6
```

Problem Set 8-8:

Use MATLAB's stairs function to generate the plot below. (If you have had ECE 350, you may recognize this as the window: u(t) –u(t –3).) Use the same scales for the axes as shown.

```
t = [-2:5];
values = [0 0 1 1 1 0 0 0];
stairs(t,values)
axis([-2 5 -0.5 1.5])
grid
title('Stairs Function')
figure
```

Results




```
% 8b. Create an array 'U' implementing the expression u(t)-u(t-3). Use
% Comparison switches (<, >, etc.) as it was demonstrated in the classroom.
```

```
U = [-2:0.01:5];
sw2 = (u > 0) - (u - 3 > 0);
plot(u, sw2)
axis([-2 5 -0.5 1.5])
grid
title('U(t) - U(t-3)')
```

Results