HW1-Q1 - Communication systems

Steps of solution:

1. Calculating cn, an, bn, c0 in terms of problem's given variables including: t0, T, A. This calculation is done by means of symbolic variables

2. Printing the results of the previous calculation via pretty() function which is used for printing mathematical statement beatifully

3. Converting these symbolic multi variable functions to function handlers. It is done because doing plotting operation is much easier with function handlers rather than symbolic functions

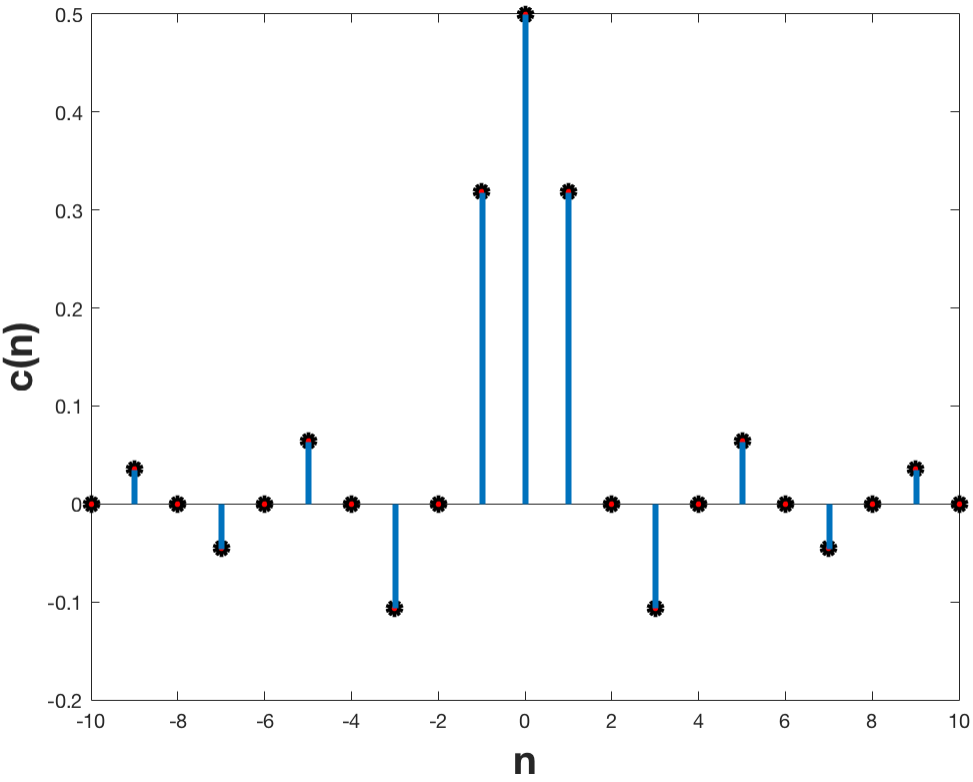
4. Plotting c(n) which is a discrete function is done by stem() function. For valuse T = 4, t0 = 1, A = 1

Note: All of the calculations are done by matlab including calculation of coefficients.

```
% Calculating fourier coefficents
syms t T n t0 A
f = 1/T;

a0 = (1/T) * int(A, t, -t0 , t0);
an = (2/T) * int(A * cos(2* pi * n * f * t), t, -t0, t0);
bn = (2/T) * int(A * sin(2* pi * n * f * t), t, -t0, t0);
cn = (1/T) * int(A * exp(-1j * 2 * pi * f * n * t), t, -t0, t0);
c0 = (1/T) * int(A, t, -t0, t0);

% Converting symbolic functions to function handlers
a0_handler  = matlabFunction(a0);
an_handler  = matlabFunction(an);
cn_handler  = matlabFunction(cn);
c0_handler  = matlabFunction(c0);

cn_vector = cn_handler(1,4,[-10:1:10], 1);
cn_vector(11) = c0_handler(1,4,1);
n_vector = -10:1:10;

% Displaying calculated results
disp('**********************')
disp('a0:')
disp(' ')
pretty(a0)
disp('**********************')
disp('an:')
disp(' ')
pretty(an)
disp('**********************')
disp('bn:')
disp(' ')
pretty(bn)
disp('**********************')
disp('c0:')
```

```
disp(' ')
pretty(c0)
disp('**********************')
disp('cn:')
disp(' ')
pretty(cn)
disp('**********************')

% Plotitng discrete spectrum
plot = stem(n_vector,cn_vector);
xlabel('n','fontweight','bold','fontsize',20)
ylabel('c(n)','fontweight','bold','fontsize',20)
plot.LineWidth = 3;
plot.MarkerFaceColor = 'red';
plot.MarkerEdgeColor = 'black';
```

```
**********************
a0:

2 A t0
------
   T

**********************
an:

     / 2 pi n t0 \
A sin| --------- | 2
     \     T     /
--------------------
        n pi

**********************
bn:

0

**********************
c0:

2 A t0
------
   T

**********************
cn:

  /    /   pi n t0 2i \      / pi n t0 2i \ \
A | exp| - ---------- | - exp| ---------- | | 1i
  \    \        T     /      \      T     / /
-------------------------------------------------
                    2 n pi

**********************
```



Obviously results obtained from discrete spectrum and calculated coefficients agree with theoretical calculations

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