In this assignment, you will write a MATLAB function and call it in another program. Your function should generate the sum of $N$ sinusoids with specified parameters. In short, you will use the following model to generate the output of the function:

$$X(t) = \sum_{n=1}^{N} A_n \cos(2\pi f_n t + \phi_n) + B_n$$

A. Creating the function

1. Write a function named `Sum_Cosine`. Your function should have the following input and output parameters:

   **Inputs:**
   - $N$: total number of sinusoids (integer, positive)
   - $A$: amplitudes of sinusoidal components ($N \times 1$ matrix with real and positive elements)
   - $f$: frequency of sinusoidal components ($N \times 1$ matrix with real and positive elements)
   - $\phi$: phase of sinusoidal components ($N \times 1$ matrix with real and positive elements)
   - $B$: constant component of signals ($N \times 1$ matrix with real elements)
   - $\text{Start}$: starting time of signals (real)
   - $\text{End}$: end time of signals (real and greater than $\text{Start}$)
   - $\text{fs}$: sampling frequency (greater than twice the maximum element in $f$)

   **Outputs:**
   - $t$: time vector ranging from $\text{Start}$ to $\text{End}$ with a sampling rate of $\text{fs}$
   - $X$: sum of sinusoids over the specified range

2. Your function should verify that the input variables meet the conditions indicated in parentheses and should generate error messages if the conditions are not met. The function should also provide a brief explanation of how it works when the command `help Sum_Cosine` is executed in the command window.

3. In the body of your function, after checking the input parameters, create a time vector given the starting and ending values and the sampling rate. Next, use a `for loop` to implement the sum of sinusoids given by the above formula.
B. Calling the function

1. Open a new script editor window and save it under the name Lab04. Define the values of the function inputs. Call the function to generate the values of output parameters. If the parameters meet the required conditions, your program should generate a plot of $X$ versus $t$ (with a proper title and axes labels).

2. Try also to use input values outside the desired range in order to see whether your function produces proper error messages. Test your function with a variety of input values (number of sinusoids, amplitudes, phases, etc.).

For your report, include your well-commented MATLAB code (both MFiles), two plots with $N = 1$ and $N = 3$ (you can determine the values of other input parameters yourself), and two examples of error messages you generate in the command window.

Question

We would like to make a plot of two signals *versus time* in the same figure window. The first signal is an amplitude modulated cosine (a 5-Hz cosine multiplied by an exponential function) and the second signal is a 1-Hz sinusoid. Both signals are sampled at 200 Hz. The following piece of code was written to generate the plot. However, there are a few bugs in the code, which result in receiving error messages and producing an incorrect plot. Try to debug the code; make a list of the bugs you found and modifications you made to fix them. Also, include a correct version of the plot in your report.

t=linspace(0,1,0.005); % time vector
x=exp(2t)*cos(2*pi*5*t); % amplitude modulated cosine
y=4*sin(2*pi*1*t); % sine function
figure;
plot(t,x,'bo-','markeredgecolor',k);
hold off;
plot(y,t,'r--','linewidth','2');