CENG 3331 Intro to Telecommunication and networks – Homework 1

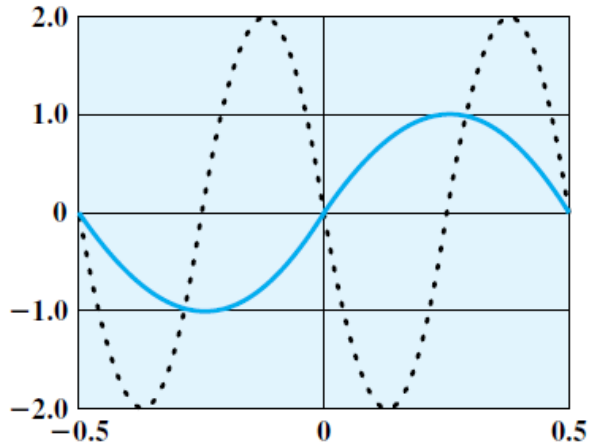
Due: at the beginning of class 9/8/2022

Problem 1 (10): A signal has a fundamental frequency of 1000 Hz. What is its period?

Problem 2 (10): Sound may be modeled as sinusoidal functions. Compare the relative frequency and wavelength of musical notes. Use 330m/s as the speed of sound and the following frequencies for the musical scale.

Note	C		D		E		F		G		A		B		C
Frequency	264		297		330		352		396		440		495		528
Frequency Difference															
Wavelength															

Problem 3 (15): If the solid curve in Figure below represents sin(2πt), what does the dotted curve represent? That is, the dotted curve can be written in the form A sin (2πft + φ); what are A, f, and φ?



Problem 4 (15): Decompose the signal (1+0.1 cos5t) cos100t into a linear combination of sinusoidal functions, and find the amplitude, frequency, and phase of each component. Hint: use the identity for cos*a*cos*b*.

Problem 5 (10): If an amplifier has a 30-dB voltage gain, what voltage ratio does the gain represent?

Problem 6 (10): An amplifier has an output of 20 W. What is its output in dBW?

Problem 7 (Extra 10): Join the discussion of 5G on Blackboard. Attach only the **screenshot** of your answer from Blackboard.

Matlab Problems:

M1 (10): sin wave simulation

Use the following codes, and answer the questions.

```
%Paremeter setting
A = 1; %Amplitude
f = 1; %frequency
P = 0; %Phase
time = 1.5; %time duration
N = 1000; %Sampling number
t = 0:time/(N-1):time;
%Generate sin wave
s = A*sin(2*pi*f*t+P);
%Draw figure
plot(t,s)
grid on
xlabel('Time')
ylabel('Amplitude')
```

Questions:

1. Run the code and plot the figure; what is the period of the output signal?
2. Change the A = 0.5, then run the code; what is the root mean square voltage of the signal?
3. Change the f = 2, then run the code; what is the period of the output signal?
4. Change the P=pi/4, then run the code; what is the value of the signal at time = 0?

M2 (10): Addition of frequency components

Now, use the code provided before to generate 2 sin waves.

$$s_1(t) = \sin(2\pi ft)$$

$$s_2(t) = \frac{1}{3}\sin(2\pi 3ft)$$

Question:

1. Plot the two frequency components.
2. Add the two frequency components together and plot it.

M3 (10): Musical notes.

Generate all the musical notes in problem 2 with the same amplitudes and phases. Change the N = 10000.

Question:

1. Put all the musical notes in one vector and use function `sound(y)` to play the sound. Include your code.
2. Play the sound [E,E,F,G,G,F,E,D,C,C,D,E,E,D,D].