UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Electrical and Computer Engineering

ECE 498MH Signal and Image Analysis

Solutions 1

Fall 2013

Assigned: Friday, September 6, 2013 Due: Friday, September 13, 2013

Reading: McClellan & Schafer 2.1-2.5

Problem 1.1

(a) $236\cos\left(\frac{\pi n}{2}+\frac{\pi}{2}\right)$

(b) $\cos\left(\frac{\pi n}{16}-\frac{\pi}{2}\right)=-\cos\left(\frac{\pi n}{16}+\frac{\pi}{2}\right)=\sin\left(\frac{\pi n}{16}\right)$

Problem 1.2

(a) $\Re\left\{544\exp\left(j\frac{\pi n}{3}\right)\right\}$

(b) $\Re\left\{26e^{j\frac{\pi}{4}}e^{j\frac{\pi n}{10}}\right\}$

(c) $\Re\left\{5e^{j\frac{\pi n}{10}}e^{-j\tan^{-1}(3/4)}\right\}$

Problem 1.3

(a) Diagram should show addition of the phasors 1 and -j.

(b) Diagram should show addition of the phasors 1 and -j.

(c) Diagram should show addition of the phasors 1 and $(3-3j)$.

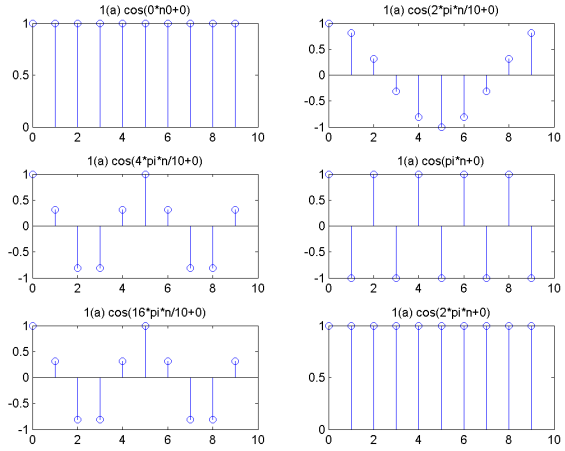
Problem 1.4

(a) $y[n]=\cos\left(2\pi\frac{3}{4}n\right)=\cos\left(\frac{2\pi n}{4}\right)$ aliased, so $z(t)=\cos\left(2\pi 1500t\right)$

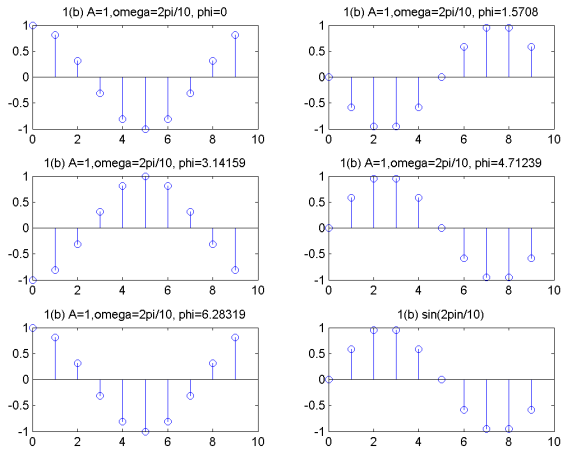
(b) $y[n]=\cos\left(2\pi\frac{3}{8}n\right)$ with no aliasing, so $z(t)=\cos\left(2\pi 4500t\right)$

Matlab Exercises

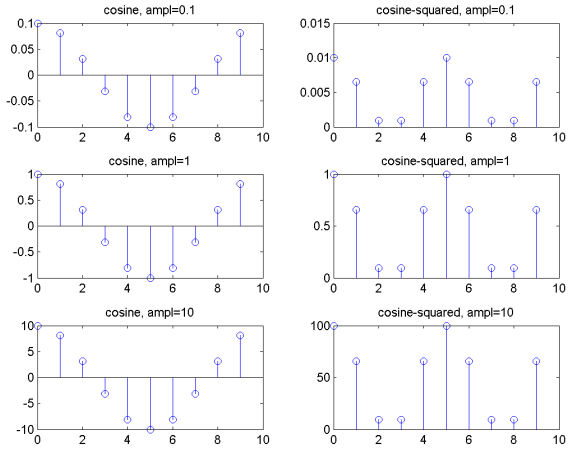
Problem 1.5



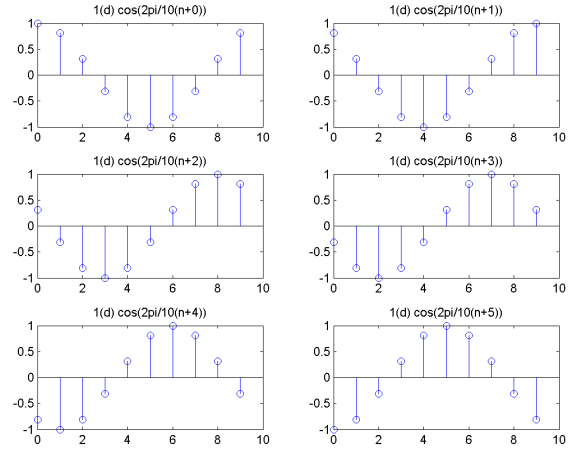
(a)



(b)

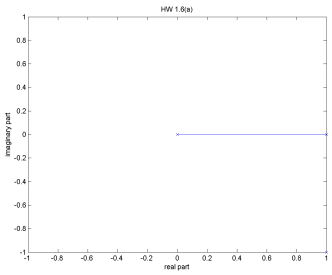

cosine, ampl=0.1
cosine-squared, ampl=0.1
cosine, ampl=1
cosine-squared, ampl=1
cosine, ampl=10
cosine-squared, ampl=10

(c)


1(d) cos(2pi/10(n+0))
1(d) cos(2pi/10(n+1))
1(d) cos(2pi/10(n+2))
1(d) cos(2pi/10(n+3))
1(d) cos(2pi/10(n+4))
1(d) cos(2pi/10(n+5))

(d)

Problem 1.6

(a) 

(b) Same as part (a).

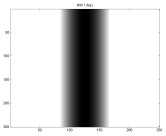
Problem 1.7

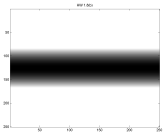
(a) Changing the frequency of a tone changes its perceived pitch.

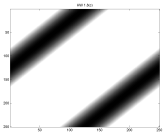
(b) Changing the amplitude of a tone changes its perceived loudness.

(c) Changing the phase of a tone changes nothing perceptible.

Problem 1.8

(a) 

(b) 

(c) 

(d)