

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Electrical and Computer Engineering
ECE 498MH SIGNAL AND IMAGE ANALYSIS

Homework 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 $(3 - 3j)$.

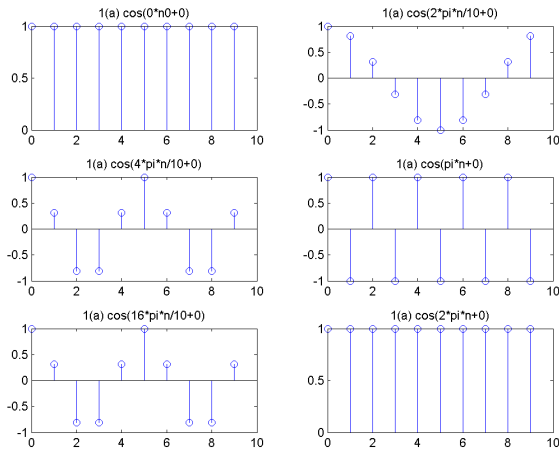
Problem 1.4

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

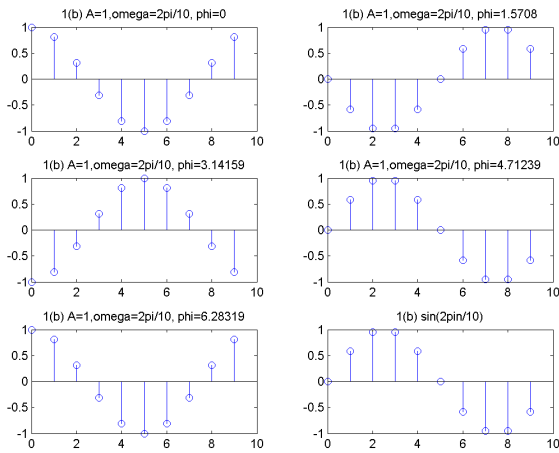
(b) $y[n] = \cos\left(2\pi\frac{3}{8}n\right)$ with no aliasing, so $z(t) = \cos(2\pi 4500t)$

Matlab Exercises

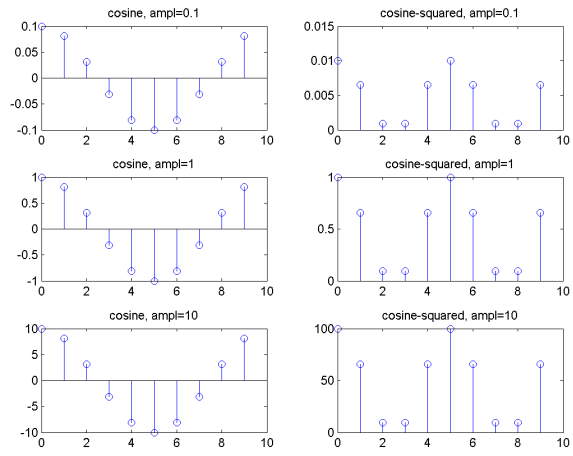
Problem 1.5



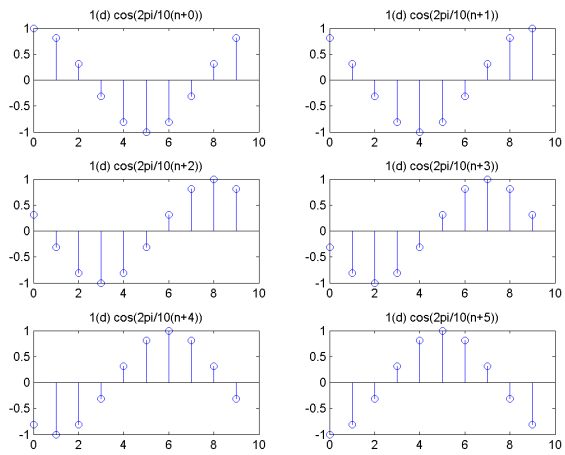
(a)



(b)

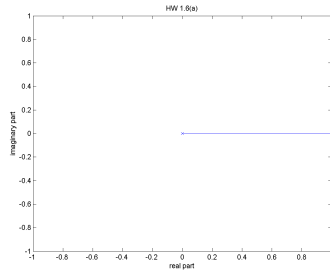


(c)



(d)

Problem 1.6



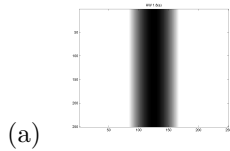
(a)

(b) Same as part (a).

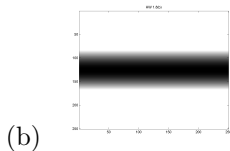
Problem 1.7

- (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.

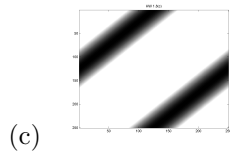
Problem 1.8



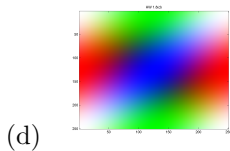
(a)



(b)



(c)



(d)