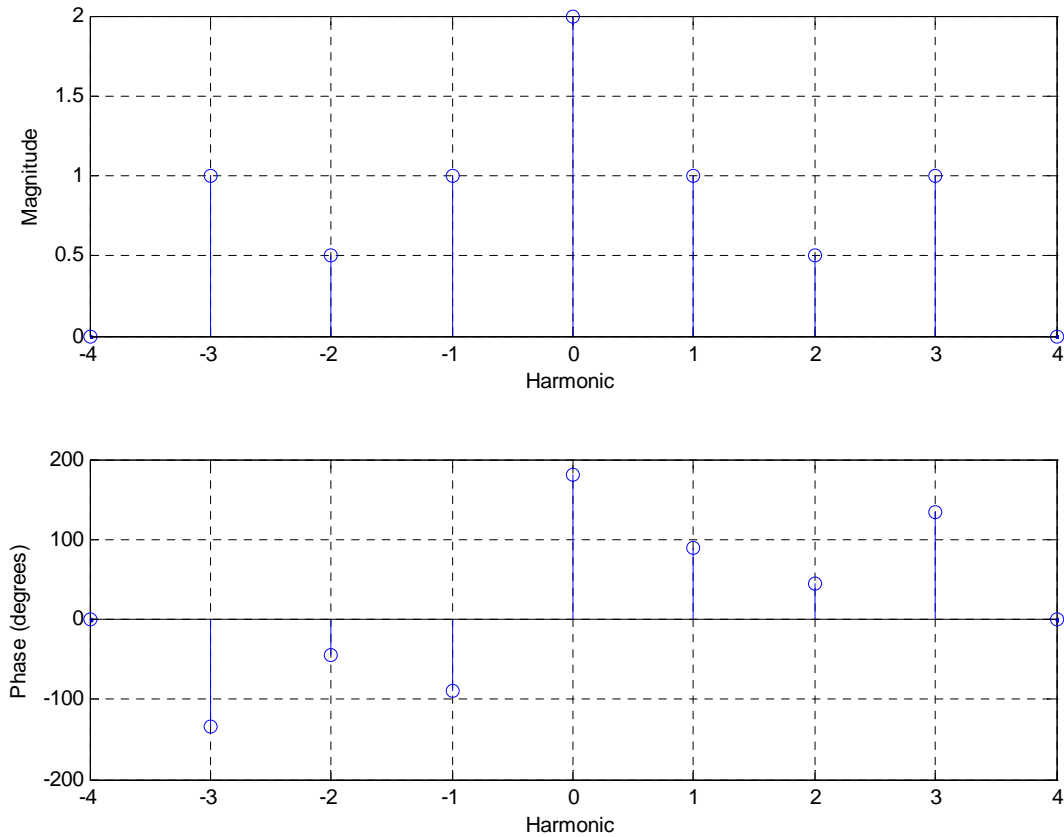


ECE 300
Signals and Systems
Homework 6

Due Date: Tuesday October 13, 2009 **at 5:15 PM**

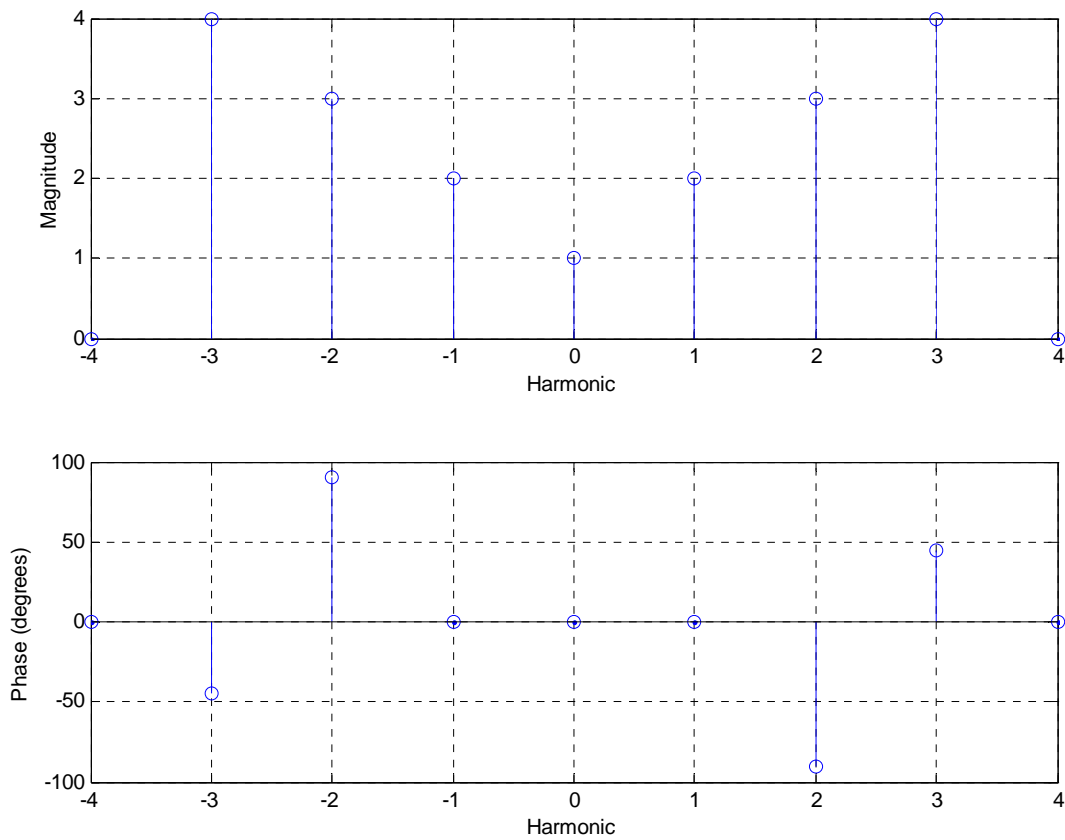
Problems:

1. Assume $x(t)$, which has a fundamental period of 2 seconds, has the following spectrum (all phases are multiples of 45 degrees)



- a) What is $x(t)$? Your expression must be real.
- b) What is the average value of $x(t)$?
- c) What is the average power in $x(t)$?

2. Assume $x(t)$ has the spectrum shown below (the phase is shown in radians) and a fundamental frequency $\omega_0 = 2 \text{ rad/sec}$:



- What is $x(t)$? Your expression must be real.
- What is the average value of $x(t)$?
- What is the average power in $x(t)$?
- What is the average power in the second harmonic of $x(t)$?

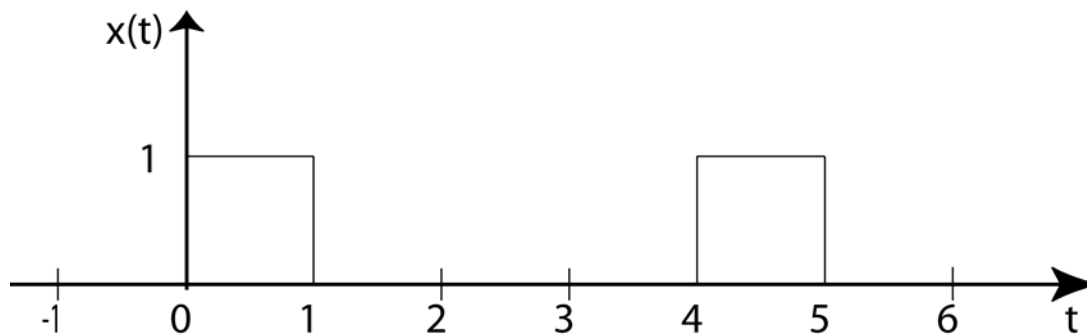
3. Simplify each of the following into the form $c_k = \alpha(k)e^{-j\beta(k)}\text{sinc}(\lambda k)$

$$\text{a) } c_k = \frac{e^{j7k\pi} - e^{-j2k\pi}}{k\pi j}$$

$$\text{b) } c_k = \frac{e^{-j2\pi k} - e^{-j5\pi k}}{jk}$$

$$\text{c) } c_k = \frac{e^{j5k} - e^{j2k}}{k}$$

Scrambled Answers $c_k = 3\pi e^{-j\frac{7\pi k}{2}} \text{sinc}\left(\frac{3k}{2}\right)$, $c_k = 3e^{j\left(\frac{7}{2}k + \frac{\pi}{2}\right)} \text{sinc}\left(\frac{3k}{2\pi}\right)$, $c_k = 9e^{j\frac{5}{2}k\pi} \text{sinc}\left(k\frac{9}{2}\right)$



4. For the periodic signal shown above, with period $T = 4$

a) Determine the fundamental frequency ω_0 .

b) Determine the average value.

c) Determine the average power in the DC component of the signal.

d) Determine an expression for the expansion coefficients, c_k . You must write your expression in terms of the **sinc** function, and possibly a leading phase term.