2.171 Problem Set 4

**Assigned:** Wed. Oct 4, 2006
Due: Wed. Oct 11, 2006, in class
Reading: F,P,&W 5.1, 5.2, 6.1, 6.2, 7.1, 7.2, 7.3, Oppenheim and Wilsky Ch. 7, Notes from class

Problem 1 Oppenheim and Wilsky, Problem 7.29

Problem 2 Oppenheim and Wilsky, Problem 7.31

Problem 3 The figure below shows a discrete-time waveform $y(k) = y_a(kT)$ which results from sampling a continuous time sinusoid $y_a(t) = \sin(\omega t + \phi)$ at sampling instants $t = kT$. Note that the waveform is periodic with period $N = 16$.
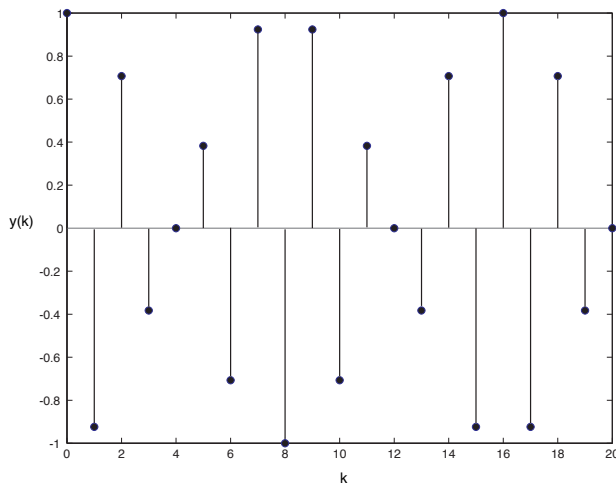
a) What are the values of ω and ϕ with the *smallest magnitudes* which could give the waveform shown above? (These will of course depend on T.) Explain your reasoning and show the relevant calculations.

b) What are *all* the possible values of ω and ϕ which could give the waveform shown above? Explain your reasoning and show the relevant calculations.

Problem 4 F,P, & W 5.7

Problem 5 F,P, & W 6.3 Only work the problem for the forward, backward, Tustin, and pole-zero matching approaches, *i.e.,* only for parts i, ii, iii, and v. Do not solve for the other transformation types. **Note:** For this problem, let $T = 0.015$ s, rather than the sample time indicated in the problem statement.

Problem 6 F,P, & W 7.3

Problem 7 F,P, & W 7.15