

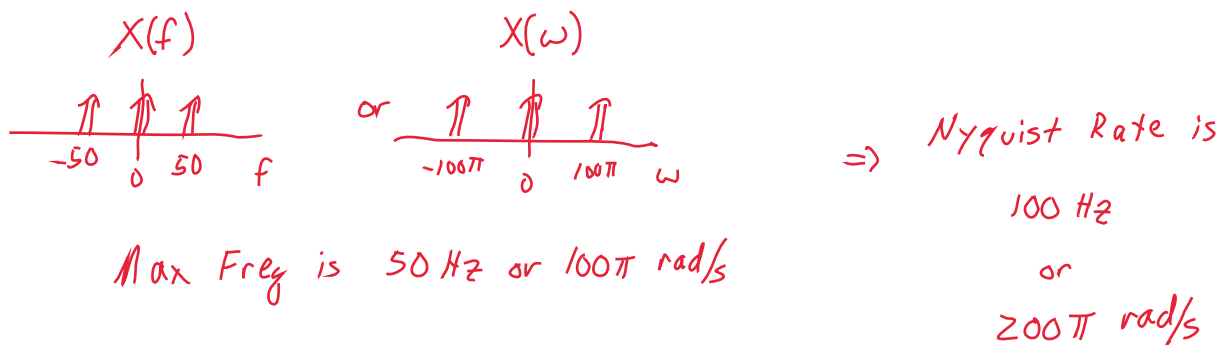
Name: *Solution*

EE3221 Digital Signal Processing
Homework/Quiz 1
Dr. Prust

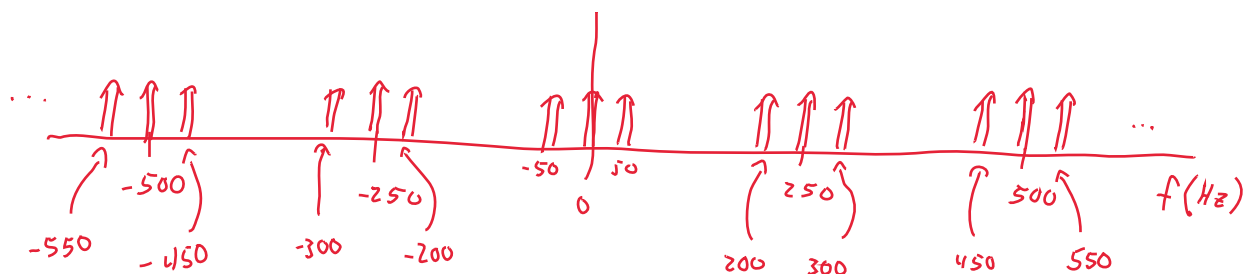
Homework Score	/ 5
Quiz Score	/ 5
Total	/ 10

1. (5 pts) Consider the signal $x(t) = \cos(100\pi t) + 2$.

(a) What is the Nyquist sampling rate for $x(t)$? Be sure to specify the units for your answer.



(b) Suppose $x(t)$ is sampled using impulse-train sampling. The sampling frequency is 250 Hz. Make a sketch showing the spectrum of the sampled signal. The frequency axis must span the range from -500 Hz to +500 Hz. You are not required to accurately label the amplitude axis.



(c) What is the Nyquist sampling rate for the signal $x^2(t)$?

$$\begin{aligned}
 x^2(t) &= (\cos(100\pi t) + 2)^2 \\
 &= \cos^2(100\pi t) + 4\cos(100\pi t) + 4 \\
 &= \frac{1}{2} + \frac{1}{2}\cos(200\pi t) + 4\cos(100\pi t) + 4
 \end{aligned}$$

\therefore Max Frequency is 100 Hz or $200\pi \text{ rad/s}$

\therefore Nyquist Rate is 200 Hz or $400\pi \text{ rad/s}$