CSE 3313 - Homework #1 - Sampling and Nyquist

- Name: Landon Moon
- ID: 1001906270

A

Determine the Sampling Frequency (f_s) from the Sampling Period

1.
   - T_s = 2 sec
   - f_s = 0.5 samples/sec

2.
   - T_s = 0.1 sec
   - f_s = 10 samples/sec

3.
   - T_s = 1 msec
   - f_s = 1,000 samples/sec

4.
   - T_s = 5 µsec
   - f_s = 200,000 samples/sec

B & C

B: Determine the bandwidth of the following real signals from their frequency spectrum?

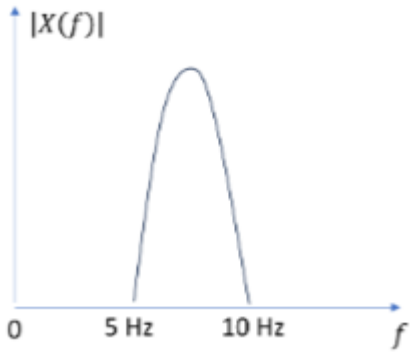
C: What are the Nyquist Sampling Frequencies for the three signal spectra in part B?

1.

B. Bandwidth = 10Hz

C. Nyquist Sampling Frequency = 20Hz

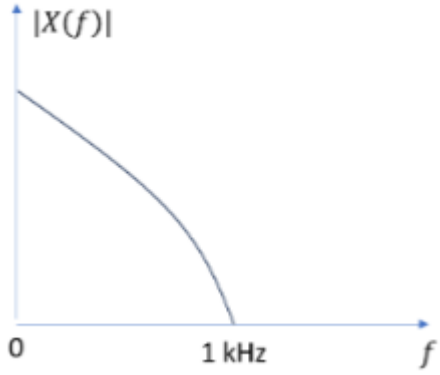
2.



B. Bandwidth = 5Hz

C. Nyquist Sampling Frequency = 10Hz

3.



B. Bandwidth = 1kHz

C. Nyquist Sampling Frequency = 2kHz

D

You have a system that can sample an analog signal into discrete samples at a sampling frequency of 100 kHz.

1.
   - Q: What is the maximum signal bandwidth you can sample without loss of signal information and allow for perfect signal reconstruction?
   - A: The maximum signal bandwidth allowed would be 50 kHz. This is because the Nyquist-Shannon Sampling Theorem says that a signal can be completely reconstructed if the sample frequency is twice the bandwidth. 50 kHz * 2 = 100 kHz.

2.
   - Q: If the signal is real and has a minimum frequency of 0 Hz, what is the largest frequency component that the signal can contain and still meet the Nyquist sampling criteria?
   - A: Similar to the answer above, the largest frequency component can be up to 50 kHz. With a minimum of 0 Hz and a maximum of 50 kHz the bandwidth would be 50 kHz which implies a minimum Nyquist Sampling Frequency of 100 kHz.