Assignment 02

SAMPLING, A/D CONVERSION AND D/A CONVERSION
Part 1 Time Domain

Sampling Process

Among the frequencies, there is a unique one that lies within the Nyquist interval. It is obtained by reducing the original f modulo-fs, that is, adding to or subtracting from f enough multiples of fs until it lies within the symmetric Nyquist interval $[-fs/2, fs/2]$. 
Aliasing occurs when the $2\pi$ periodic extensions of the bandlimited $x(t)$ overlap at $\Omega = \pi/T_s$ or similarly $\omega = \pi$. It is not possible to "separate" the overlapping bandwidth for perfect reconstruction.

Consider the following magnitude spectrum of a signal. We can visualize aliasing using the "Fan Folding" method.

Note: Each symmetric $2\pi$ range is shown in a different colour.

For the entire example spectrum, the aliasing is as follows.
\[ x[n] = \sin\left(2\pi \frac{f_0}{f_s} n + \phi \right) \quad f_s = 8 \text{ kHz} \]
$Fa = f \mod(fs)$
Simulate a continuous sinusoid

\[ x(t) = \cos(2\pi f_0 t) \approx \cos(2\pi f_0 \ n \ \Delta t) \quad n=0,1,2,... \ f_0 \ 2\text{kHz} \]

\[ \Delta t = 1/80000 \]
keep one sample in every 10 samples
sample and hold (padding zeros)

Filter this part
Filtering

\[ [b, a] = \text{cheby2}(9, 60, fs*1/80000); \]
\[ y = \text{filter}(b,a,xf); \]
Aliasing occurs when the $2\pi$ periodic extensions of the bandlimited $x(t)$ overlap at $\Omega = \pi/T_z$, or similarly $\omega = \pi$.

It is not possible to "separate" the overlapping bandwidth for perfect reconstruction.

Consider the following magnitude spectrum of a signal. We can visualize aliasing using the "Fan Folding" method.

Note: Each symmetric $2\pi$ range is shown in a different colour.

For the entire example spectrum, the aliasing is as follows.
Complete all the assignment. Explain if there is aliasing.

Thanks