Lab-3 Report

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Q-3.1:

The script for moving average is in MovingAverage.m file.

(d) The given signal in q1.mat file was a ramp function with added noises. Through the moving average we can reduce the noise and convert the signal closer to the original one.

If we take n = 28, we get a signal close to ramp signal, which was our actual input signal without noise.

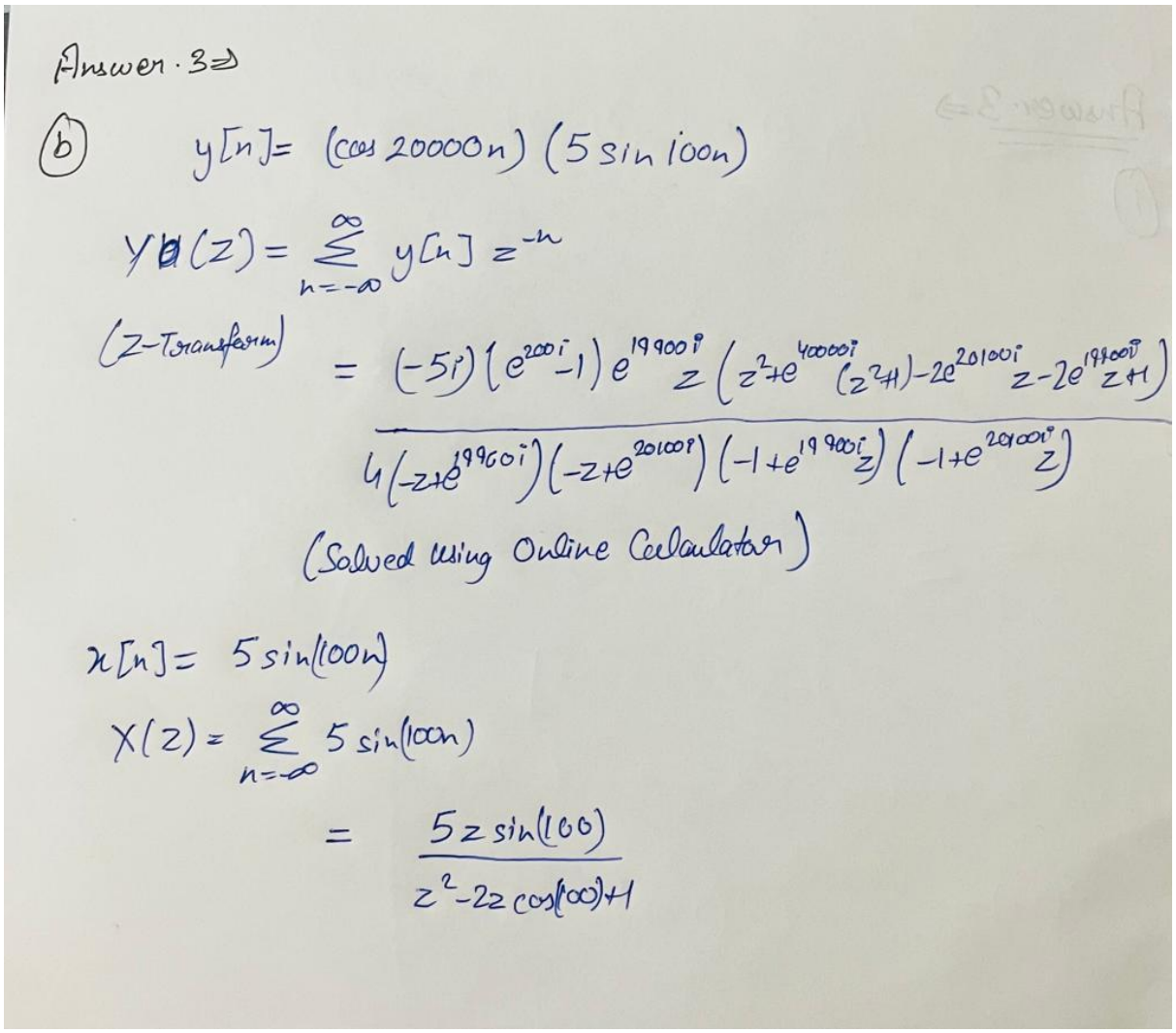
Q-3.2:

The script for first and zero order interpolation is in upsampler_firstorder.m and upsampler_zeroorder.m files, respectively.

(b) Through upsampling we can increase the information contained in a signal. Upsampling with first order interpolation is better than the one with zero order interpolation as we get smoother graph in the first one. It averages out the information of adjacent discrete times and is thus better than just holding on to the value at previous time value.

Eight cases of combination of file, m value and type of interpolation have been implemented in 8 different files (q2_1, q1_2, ……., q1_8) along with .png files having corresponding plots with same name.

Q-3.3:



Answer - 3 ⇒

(b) $y[n] = (\cos 20000n)(5 \sin 100n)$

$Y(z) = \sum_{n=-\infty}^{\infty} y[n] z^{-n}$

(Z-Transform)

$$= \frac{(-5i)(e^{200i}-1)e^{19900i} z\left(z^2+e^{40000i}(z^2+1)-2e^{20100i} z-2e^{19900i} z+1\right)}{4\left(-z+e^{19900i}\right)\left(-z+e^{20100i}\right)\left(-1+e^{19900i} z\right)\left(-1+e^{20100i} z\right)}$$

(Solved using Online Calculator)

$x[n] = 5\sin(100n)$

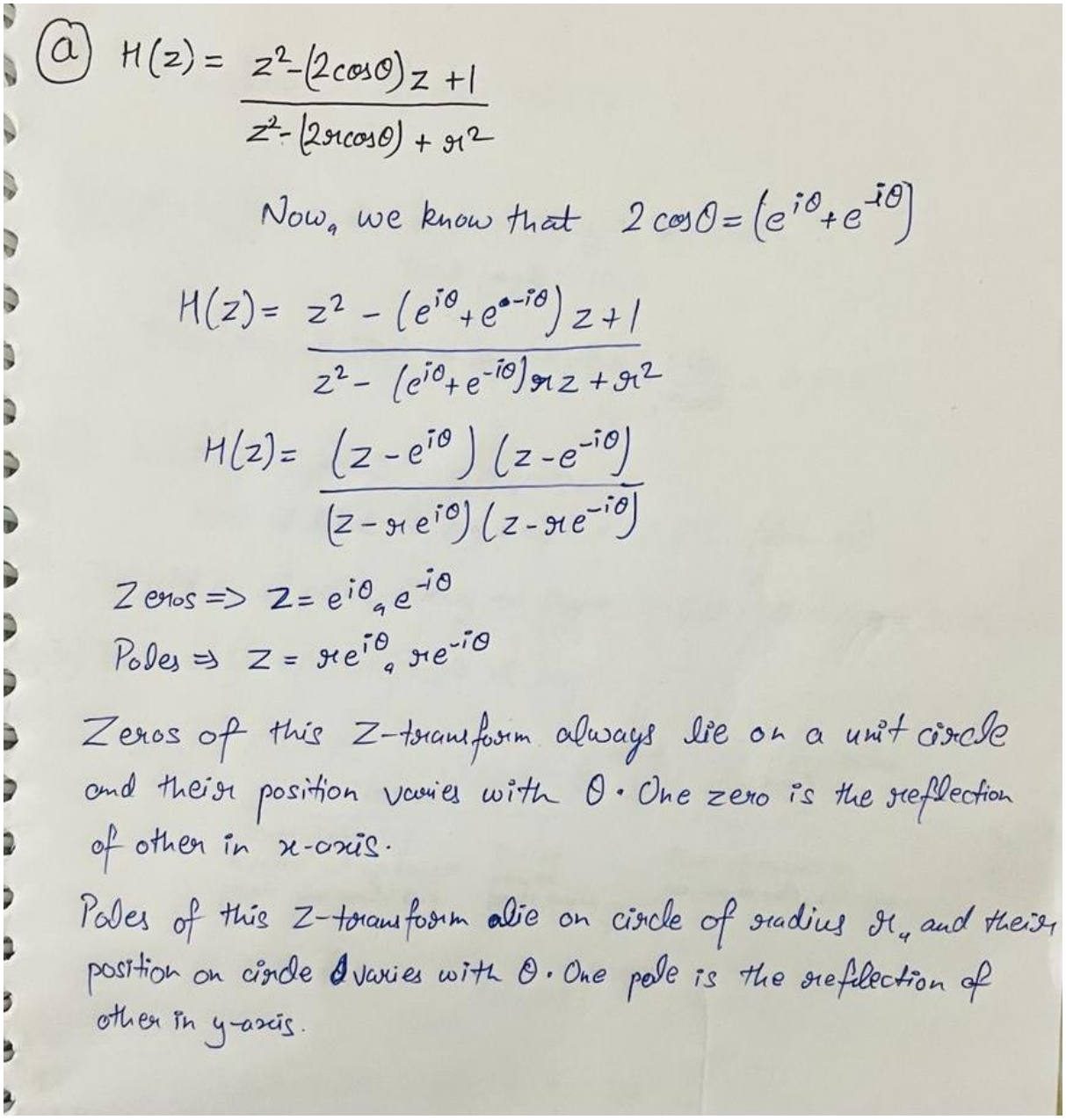
$X(z) = \sum_{n=-\infty}^{\infty} 5\sin(100n)$

$$= \frac{5z\sin(100)}{z^2 - 2z\cos(100)+1}$$

$H(z) = \frac{Y(z)}{X(z)}$ = The expression after substituting $Y(z)$ and $X(z)$

Q-3.4:

(a)



(a) $H(z) = \dfrac{z^2 - (2\cos\theta)z + 1}{z^2 - (2r\cos\theta) + r^2}$

Now, we know that $2\cos\theta = (e^{i\theta} + e^{-i\theta})$

$$H(z) = \frac{z^2 - (e^{i\theta} + e^{-i\theta})z + 1}{z^2 - (e^{i\theta} + e^{-i\theta})rz + r^2}$$

$$H(z) = \frac{(z - e^{i\theta})(z - e^{-i\theta})}{(z - re^{i\theta})(z - re^{-i\theta})}$$

Zeros $\Rightarrow z = e^{i\theta}, e^{-i\theta}$

Poles $\Rightarrow z = re^{i\theta}, re^{-i\theta}$

Zeros of this Z-transform always lie on a unit circle and their position varies with θ. One zero is the reflection of other in x-axis.

Poles of this Z-transform also lie on circle of radius r, and their position on circle also varies with θ. One pole is the reflection of other in y-axis.

(b)

Not taught in class yet.