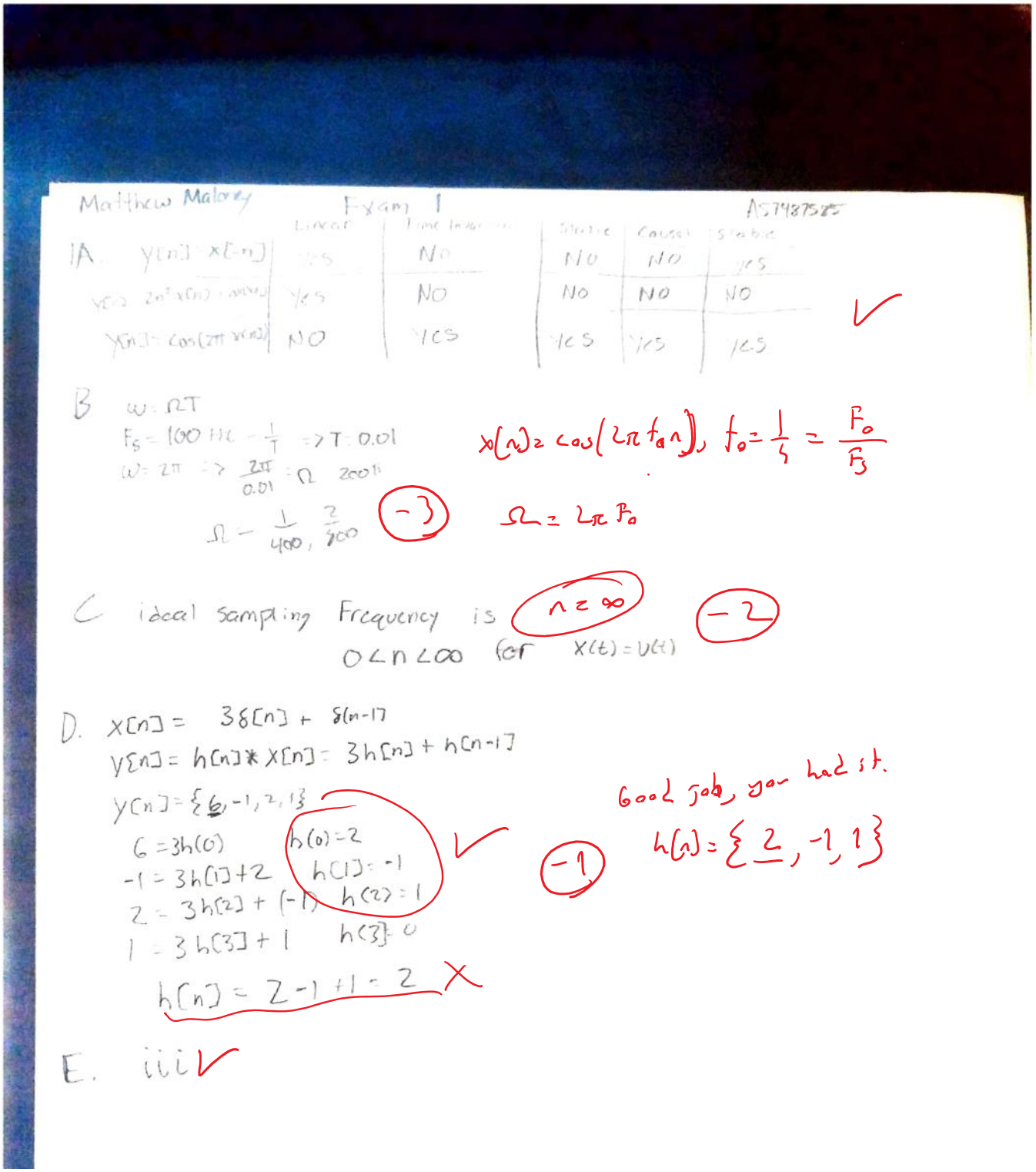
Matt Maloney

Wednesday, February 23, 2022 11:05 PM

62.5

Not bad.
Need practice on
time domain analysis.



Matthew Maloney — Exam 1 — AS7487585

1A.

	Linear	Time Invariant	Static	Causal	Stable
$y[n] = x[-n]$	YES	NO	NO	NO	YES
$y[n] = 2n^2 x[n] + \text{noise}$	YES	NO	NO	NO	NO
$y[n] = \cos(2\pi x[n])$	NO	YES	YES	YES	YES

✓

B $\omega = \Omega T$

$F_s = 100\ Hz \rightarrow \frac{1}{T} \Rightarrow T = 0.01$

$\omega = 2\pi \Rightarrow \frac{2\pi}{0.01} = \Omega \quad 200\pi$

$\Omega = \frac{1}{400}, \frac{3}{400}$ (-3)

$x(n) = \cos(2\pi f_0 n)$, $f_0 = \frac{1}{5} = \frac{F_0}{F_s}$

$\Omega = 2\pi F_0$

C ideal sampling Frequency is $n = \infty$ (-2)

$0 < n < \infty$ for $X(t) = U(t)$

D. $x[n] = 3\delta[n] + \delta[n-1]$

$y[n] = h[n] * x[n] = 3h[n] + h[n-1]$

$y[n] = \{6, -1, 2, 1\}$

$6 = 3h(0)$ $h(0) = 2$

$-1 = 3h[1] + 2$ $h[1] = -1$

$2 = 3h[2] + (-1)$ $h(2) = 1$

$1 = 3h[3] + 1$ $h(3) = 0$

✓ (-1)

Good job, you had it.

$h[n] = \{2, -1, 1\}$

$h[n] = 2 - 1 + 1 = 2$ X

E. iii ✓

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2 $y[n] - \frac{2}{15} y[n-1] - \frac{1}{15} y[n-2] = x[n]$

A Find $H[n]$

$\lambda^n - \frac{2}{15}\lambda^{n-1} - \frac{1}{15}\lambda^{n-2} = 0$

$(\lambda - 2.4)(\lambda + 0.4)$ (0.3, 0.2)

$h[n] = [C_1 (2.4)^n + C_2 (-0.4)^n] u[n]$ ✓

$y[0] = 1$

$y[1] = \frac{2}{15} y[0] = \frac{2}{15}$ ✓

$h[0] = C_1 + C_2 = 1$ ($C_1 = 1 - C_2$)

$h[1] = 2.4C_1 - 0.4C_2 = .13$ ($2.4 - C_2 2.4$)

$C_1 = -0.23$

$C_2 = 1.23$ ✓

$h[n] = -0.23(2.4)^n + 1.23(-0.4)^n] u[n]$ ✓

B. Stable roots > 1, FIR IIR (-2)

C. ZSR $x[n] = u[n]$

$y_p[n] = K u[n]$

$K u[n] - K\frac{2}{15}^{n-1} - K\frac{1}{15}^{n-2} u[n] = K u[n]$ (-6)

$n \geq 1$

$K =$

D ZIR (-8)

E (-2) You can just write Total = ZIR + ZSR for partial points. Show your knowledge.

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3. $H(z) = \frac{1+z^{-1}}{1-\frac{3}{5}z^{-1}+\frac{2}{25}z^{-2}}$

A. $Y(z) - \frac{3}{5}z^{-1}Y(z) - \frac{2}{25}Y(z)z^{-2} = X(z) + z^{-1}X(z)$ ✓

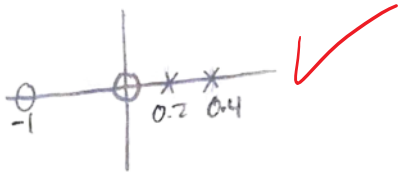
$y[n] - \frac{3}{5}y[n-1] - \frac{2}{25}y[n-2] = x[n] + x[n-1]$

$\frac{1}{+}$ (-1)

B. Gain is positive (-1.5)

Yes, but what?

C. $H(z) = \frac{z^2+z}{z^2-\frac{3}{5}z+\frac{2}{25}} = \frac{z(z+1)}{(z-0.2)(z-0.4)}$



✓

D ROC $|z| > 0.2$ $|z| > 0.4$

$|z| > 0.4$ (-3)

E. Yes system is stable from all poles inside of unit circle ✓

F. $x[n] = \frac{2}{5}u[n] + \frac{1}{5}u[n]$ IDK ✗ (-6)

Use $X(z) = \frac{Y(z)}{H(z)}$

then finding $x[n]$ is easy.

At least for this question