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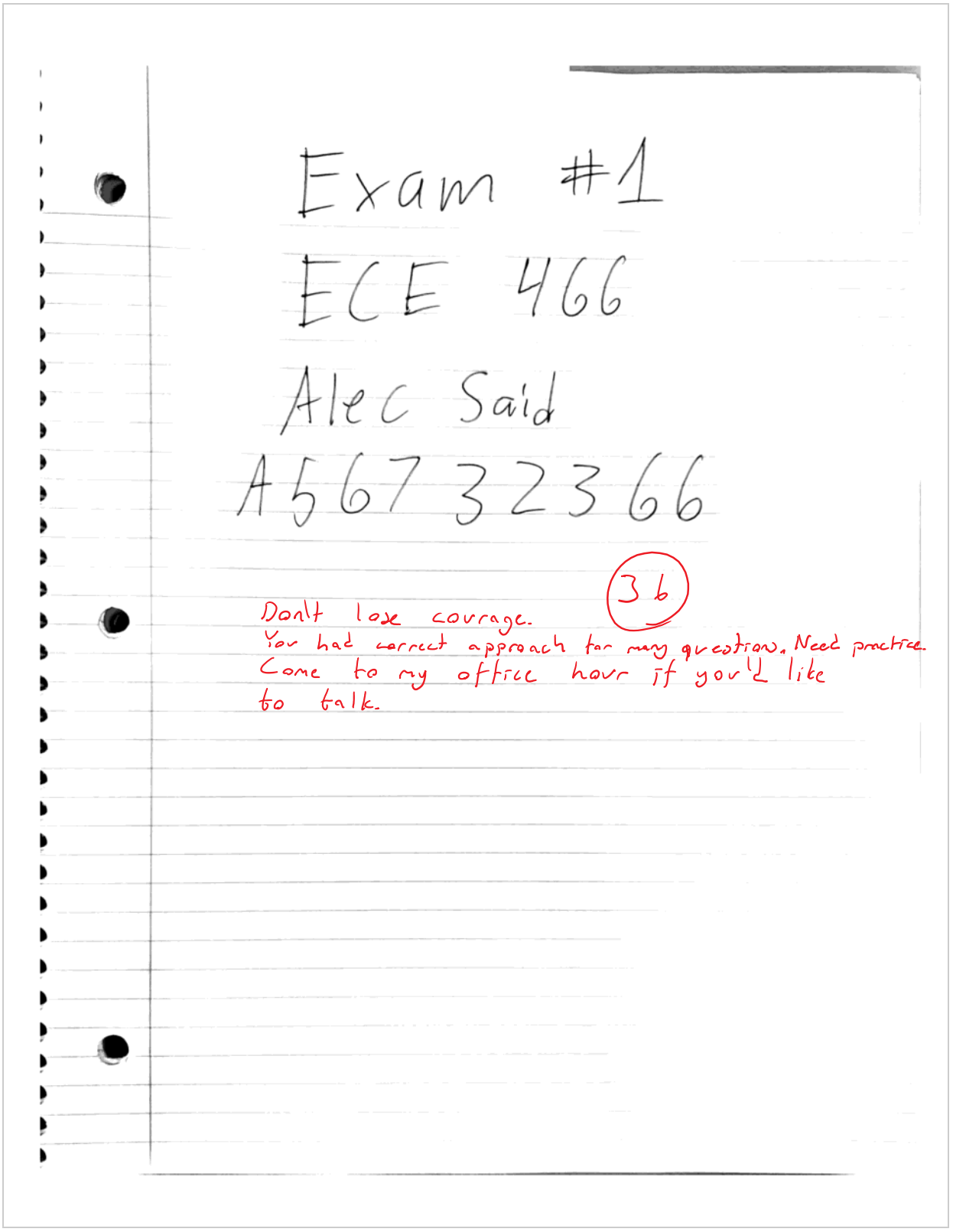


Question #1

a) $Y[n] = X[-n]$: Linear, time varying, Dynamic noncausal, BiBO Stable ✓

$Y[n] = 2n^2 x[n] + nx[n+1]$: Time varying, Dynamic, noncausal, BiBO unstable ✓ (-1) → Linearity? (-1)

$Y[n] = \cos(2\pi x[n])$: time varying, static, Causal, BiBO Stable ✓ (-1)

b) $x(n) = \cos\left(\frac{\pi}{2}n\right) \rightarrow \Omega = \frac{\pi}{2} \quad \Omega = \frac{-\pi}{2}$

because $\cos(\Omega)$ at $\pm\frac{\pi}{2}$ results in similar signals (-4)

c) $\frac{100}{8} = 12.5\ Hz$ ∞ (-4)

d) (-5)

e) (-10) Just give any answer next time.

Question 2

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

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

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

$\left(-\frac{2}{15}\right)$ $\left(\frac{4}{15}\right)^{\frac{1}{2}}$ $\left(-\frac{1}{15}\right)$

$$\frac{-\left(\frac{1}{15}\right) \pm \sqrt{\left(\frac{1}{15}\right)^2 - 4(1)\left(\frac{-1}{15}\right)}}{2\left(\frac{2}{15}\right)} \rightarrow -\frac{1}{15} + \frac{\sqrt{141}}{15}, \quad -\frac{1}{15} - \frac{\sqrt{141}}{15}$$

-2

$y(0) = C_1(1) + C_2(-1)$ $\quad C_1 = 1, \quad C_2 = -1$

LTI -2

b) FIR, Stable

c) $y_n(n) = C_1(1)^n u[n] + C_2[-1]^n u[n]$ — Why!

$y_p[n] = k(1)^n u[n]$

$k(-1)^n u[n] + \left(-\frac{2}{15}\right)k - \left(\frac{1}{15}\right)k = 0 \rightarrow v[2] = 1$ $\quad -4$

$C_1 + C_2 = 1 \rightarrow$ Nope. $\quad C_1 = C_2 + 1 \rightarrow C_1 = 4 + 1 = C_1 = 5$ $\quad -C_2$

$\frac{2C_1}{15} + \frac{1C_2}{15} = 1 \rightarrow \frac{2C_2 + 2}{15} + \frac{C_2}{15} = -15 \Rightarrow 3C_2 + 2 = 15$

$\frac{3}{3}C_2 = \frac{12}{3}$

$C_2 = 4$

$$y_{ZSR}(n) = 5\left(\frac{2}{15}\right)^n + 4\left(\frac{1}{15}\right)^n u[n]$$

Wrong

d) $y[n] + \frac{1}{15} y[n-1] - \frac{2}{15} y[n-2] = 0$

$\frac{-2 \pm \sqrt{4 - 60}}{15} \rightarrow \frac{-1}{15} \pm \frac{\sqrt{14}\,i}{15}$

-1

$2n = 30$

$y_h(n) = C_1\left(\frac{-1}{15} + \frac{\sqrt{14}\,i}{15}\right) + C_2\left(\frac{-1}{15} - \frac{\sqrt{14}\,i}{15}\right)$

$y(0) = \frac{\sqrt{14}\,i - 1}{15} + \cdot$

$y_{zie}[n] = 1\left(\frac{-6\sqrt{14}\,i}{15}\right) + 1\left(\frac{\sqrt{14}\,i - 1}{15}\right)$

Solve this in terms of IC.

undefined

e) There is no force response the response = 0 since the undefined aspect kills the input

-2

Question 3

a)

$u_n \rightarrow \frac{1}{1-z^{-1}}$

$\alpha^n u[n] \rightarrow \frac{1}{1-\alpha z^{-1}}$

No need to decompose. Use relationship between LCCDE and z transform

$u[n]$

$1+z^{-1}$

$1-\frac{3}{5}z^{-1}+\frac{2}{25}z^{-2}$

(-3)

$-\frac{3}{5}\alpha^n u[n] \quad \frac{2}{25}\alpha^n[n]$

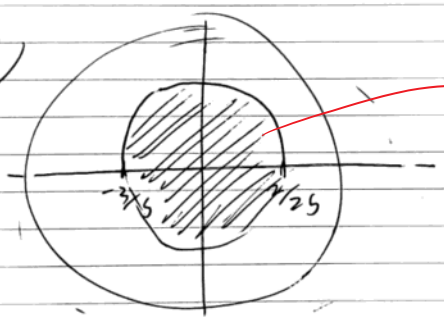
$\frac{-3}{5}\alpha^{n-1}u[n]+\frac{2}{25}\alpha^{n-2}[n]$

$u[n]$

b)

(-2)

c)



The system is causal.

ROC: $|z| > \frac{2}{5}$

(-3) Zeros?

d) $|z| > 1 \rightarrow u[n] \quad \alpha^n u[n] \rightarrow |\alpha| < |z|$

So α?

(-2)

$|\alpha| < |z| > 1$

e) (-5) f) (-8)