1. **A.** h[n]=Th(t=nT)=(0.2)$10e^{-10(0.2n)}$u(0.2n)=$2e^{-2n}$u[n].

2. **A.** s=$\frac{2}{T}\frac{z-1}{z+1}$ $\rightarrow$ $H(z)$=$\frac{10}{10\frac{z-1}{z+1}+10}$=$\frac{10(z+1)}{10(z-1)+10(z+1)}$=$\frac{1}{2}(1+z^{-1})$. Average 2 most recent.

3. **D.** 10=Ω=$\frac{2}{T}\tan(\frac{\omega}{2})$ $\rightarrow$1=tan($\frac{\omega}{2}$) $\rightarrow$ ω=$\pi/2$ (not $\pi/4$).

4. **C.** $H_a(s)$=s and s=$\frac{2}{2}\frac{z-1}{z+1}$ $\rightarrow$ $H(z)$=$\frac{z-1}{z+1}$=$\frac{Y(z)}{X(z)}$ $\rightarrow$y[n]+y[n-1]=x[n]–x[n-1]

5. **C.** Bilinear transform maps Re[s]$< 0 \rightarrow |z| < 1$, so stable&causal$\rightarrow$stable&causal.

6. **B.** h[n]=$\{a, \underline{b}, a\}$ $\rightarrow$ $H(e^{j\omega})$=a$e^{j\omega}$+b+a$e^{-j\omega}$=b+2acos(ω). Solve these equations: $\omega = 0$: 1=b+2a. $\omega = \pi$: 0=b–2a. $\omega = \frac{\pi}{2}$: $\frac{1}{2}$=b+0a$\rightarrow$a=$\frac{1}{4}, b = \frac{1}{2}$ $\rightarrow$ h[n]=$\{\frac{1}{4}, \frac{1}{2}, \frac{1}{4}\}$.

7. **E.** $h_{IDEAL}[n]$=$\frac{\sin(\frac{\pi}{2}n)}{\pi n}$ $\rightarrow$h[n]=w[n]$h_{IDEAL}[n]$=$\frac{\sin(\frac{\pi}{2}n)}{\pi n}, |n| \leq 1 = \{\frac{1}{\pi}, \frac{1}{2}, \frac{1}{\pi}\}$.

8. **D.** Could have used `fir1` for #8 and `fir2` for #7 (with different arguments).

9. **D.** a+b+0–b–a=0 and a$(-1)^2$+b(–1)+0–b(–1)–a$(-1)^2$=0.

10. **B.** A blurs the points; C makes the points only more prominent!

11. **A.** (b) doesn't help; (c) makes noise worse since it enhances high frequencies.

12. **E.** (a) blurs image features; both (b) and (c) can help.

13. **A.** Only A does not reject DC and emphasize high frequencies.

14. **C.** Increasing N does not help resolve peaks unless N was very small.

15. **A.** Does not reduce sidelobes, only width of main peak (see formula in notes).

16. **E.** Reduces resolution and convolves spectrum with window's spectrum, smoothing.

17. **C.** Downsampling by 2 doubles frequency to 600 Hz, which is aliased down to 400 Hz. The reconstructor output is never more than half the sampling rate, so no 600 Hz.

18. **B.** Upsampling halves frequency, but also brings in the aliased version (350 Hz) of it.

19. **F.** A and C reduce, not raise, frequency. B and D first cause unrecoverable aliasing. In E 350 Hz gets aliased. F works: LPF both eliminates 350 Hz and avoids aliasing.

20. **A.** Don't even think about asking for partial credit!

SCORES	95	90	85	80	75	70	65	60	55	Total	Mean	Median
#ugrad	1	12	9	17	10	10	3	3	1	66	78.5	80
#grad	0	1	3	2	1	0	0	0	0	7	82.9	85