1a. $\boxed{YES}$ is LTI. This is a constant-coefficient MA difference equation.

1b. $\boxed{NO}$ not causal since $y[n]$ depends on future inputs $\{x[n{+}1], x[n{+}2], \ldots\}$

1c. Read off impulse response $h[n]=\boxed{\{\ldots \frac{1}{3}, -\frac{1}{2}, 1, \underline{0}, -1, \frac{1}{2}, -\frac{1}{3} \ldots\}}$

1d. $\boxed{NOT}$ BIBO stable since $\sum |h[n]| = 2(1+\frac{1}{2}+\frac{1}{3}+\ldots)$ diverges. Note $\sum h[n]=0$.

1e. $\boxed{x[n] = -(-1)^n \text{sgn}[n]}$=sgn($h$[–n]) makes $y[0]=\sum |h[n]|$ which diverges.

2a. {(3)(6),(3)(7)+(4)(6),(3)(8)+(4)(7)+(5)(6),(4)(8)+(5)(7),(5)(8)}=$\boxed{\{\underline{18}, 45, 82, 67, 40\}}$.

2b. u[n]+2u[n–1]–3u[n–2]=$\boxed{\{\underline{1}, 3\}}$ since 1+2=3 (n=1) and 1+2–3=0 ($n \geq 2$).

2c. u[n]–u[n–3]=$\{\underline{1}, 1, 1\}$ so get {3,3+4,3+4+5,4+5,5}=$\boxed{\{\underline{3}, 7, 12, 9, 5\}}$.

2d. Convolution by delayed impulse delays signal so get $\boxed{\{\underline{0}, 0, 2, 4, 8\}}$.

3a. Suppose IS time-invariant. Then it is LTI. Write the 1^{st} input in terms of the 2^{nd}:
$\{\underline{1}, 2, 3\}=\delta[n]+2\delta[n-1]+3\delta[n-2]$. Then since the system is LTI:
$\{\underline{1}, 2, 3\}=\delta[n]+2\delta[n-1]+3\delta[n-2] \rightarrow \{\underline{1}, 3\}+\{\underline{0}, 2, 6\}+\{\underline{0}, 0, 3, 9\}=\{\underline{1}, 5, 9, 9\}$.
But this contradicts $\{\underline{1}, 2, 3\} \rightarrow \{\underline{1}, 4, 7, 6\}$. So the system is not time-invariant.

3b. $\{\underline{1}, 2, 3\} * \{\underline{h[0]}, h[1]\}=\{\underline{1}, 4, 7, 6\}$ since durations of each sequence are 3+2–1=4.
1h[0]=1; 2h[0]+1h[1]=4; 3h[0]+2h[1]=7; 3h[1]=6 are all satisfied by h[n]=$\boxed{\{\underline{1}, 2\}}$.
If there were no consistent solution, h[n] must have infinite duration.

4a. **n=0**: y[0]–y[–1]–y[–2]=x[0]→y[0]-0-0=1→y[0]=1.
n=1: y[1]–y[0]–y[–1]=x[1]→y[1]–1-0=0→y[1]=1.
n=2: y[2]–y[1]–y[0]=x[2]→y[2]–1–1=0→y[2]=2.
n=3: y[3]–y[2]–y[1]=x[3]→y[3]–2–1=0→y[3]=3.
n=4: y[4]–y[3]–y[2]=x[4]→y[4]–3–2=0→y[4]=5.
n=5: y[5]–y[4]–y[3]=x[5]→y[5]–5–3=0→y[5]=8.
n=6: y[6]–y[5]–y[4]=x[6]→y[6]–8–5=0→y[6]=13.

4b. `Y=filter([1],[1 -1 -1],[1 zeros(1,6)]);Y(1:7)` gives `1 1 2 3 5 8 13`

5a. The voice saying "Matlab–Breakfast of Champions" with high-frequency noise added.

5b. The spectrum (below left) has high-frequency noise in a band above 8000 Hertz.

5c. Most of the noise, but not all, has been eliminated. The voice is much clearer.

5d. The spectrum (below right) still has a much-smaller band of high-frequency noise.
The convolution with this small lowpass filter eliminated much (not all) of the noise.