1. h = [1, 2, 1] and x = [1, 1]. What is y?

   ☐ 1, 3, 4, 3, 1

   ☐ 1, 2, 1

   ☐ 2, 4, 2

   ☐ 1, 3, 3, 1

2. The DFT treats its N samples as one period of a signal that repeats for ever.

   ☐ True ☐ False

3. How many operations does a direct 256-point DFT take?

   _____

4. An FIR filter is stable whatever its tap values.

   ☐ True ☐ False

5. A biquad has three numerator coefficients and three denominator coefficients, one of which is normalised to 1. How many coefficients must be stored?

   _____

6. 48 kHz audio is decimated by 4. Below what frequency must it be low-passed first, in kHz?

   _____ kHz

7. A specification line the design fails should be left out of the report.

   ☐ True ☐ False

8. A system with h[n] = 1.1^n for n $\geq$ 0 is BIBO stable.

   ☐ True ☐ False

9. A 256-point DFT runs at f_s = 8 kHz. What frequency is bin 32, in Hz?

   _____ Hz

10. How many butterfly stages does a 512-point FFT have?

    _____

1. **1, 3, 3, 1**

   y[0] = 1; y[1] = 2 + 1 = 3; y[2] = 1 + 2 = 3; y[3] = 1. The output is len(h) + len(x) − 1 = 4 samples long.

2. **True**

   Sampling the spectrum makes the time signal periodic. That is where leakage comes from.

3. **65536**

   $256^2 = 65\,536$.

4. **True**

   Its impulse response is a finite list, so the sum of |h[n]| is always finite.

5. **5**

   Three numerator plus two denominator coefficients. The 67-tap FIR stores 67.

6. **6 kHz**

   The new rate is 12 kHz, so its Nyquist frequency is $48/(2 \times 4) = 6$ kHz.

7. **False**

   Every line gets its measured value, failures included. Silent goals hide exactly what a reader needs to know.

8. **False**

   The terms grow, so their sum diverges. A step input would drive the output without limit.

9. **1000 Hz**

   $32 \times 8000/256 = 1000$ Hz.

10. **9**

    $\log_2 512 = 9$ stages, each of 256 butterflies.