Quiz 1

1. **A 2 bit ADC with a 0 to 4 volt input signal range subjected to a 1.4 volt signal will output a value. Assume this is a normal ADC with, $\text{error} = \pm\frac{1}{2}Q$**
   a. **0**
   b. **1**
   c. **2**
   d. **3**
   e. **None of the above**
2. **To avoid aliasing the waveform $A\sin(2\pi 100)$ which of the following sampling rates are acceptable?**
   a. **50 samples/sec**
   b. **100 samples/sec**
   c. **150 samples/sec**
   d. **300 samples/sec**
3. **The slope of the static calibration curve is called the**
   a. **static slope**
   b. **calibration coefficient**
   c. **sensitivity coefficient**
   d. **static sensitivity**
4. **Randomized sampling during a static calibration will minimize**
   a. **interference errors**
   b. **hysteresis errors**
   c. **extraneous variables**
   d. **precision errors**

5. **A 3 bit ADC has how many possible output values?**
    a. **3**
    b. **6**
    c. **8**
    d. **$3^2 = 9$**
    e. **None of the above**
6. **By increasing the signal gain (amplifying the signal) the quantization error will increase.**
    a. **True**
    b. **False**
7. **What is the frequency of the waveform $\sin(\pi 100)$?**
    a. **50 Hz**
    b. **100 Hz**
    c. **100 radians/sec**
    d. **50 radians/sec**
    e. **None of the above**
8. **If I sample a data set at 1000 samples/sec what is the Nyquist frequency?**
    a. **2000 Hz**
    b. **1000 Hz**
    c. **500 Hz**
    d. **1000/(2π) Hz**
    e. **None of the above**

9. **The most common analog to digital converters are classified as?**
    a. **successive approximation**
    b. **Ramp**
    c. **Parallel or Flash**
    d. **Sigma-Delta**
    e. **None of the above**
10. **Currently Sigma-Delta ADC have the highest resolution.**
    a. **True**
    b. **False**
11. **The lowest signal-to-noise ratio that could be achieved with the hardware in our lab is?**
    a. **log 2^{12}**
    b. **20 log 2^{12}**
    c. **ln 2^{12}**
    d. **20 ln 2^{12}**
    e. **None of the above**
12. **The twos complement output of -2 from a 4 bit ADC would be?**
    a. **1010**
    b. **1101**
    c. **1110**
    d. **0010**
    e. **None of the above**

13. What portion of the repeated sampling of a static temperature signal are within one standard deviation of the mean value?

- **a. 5%**
- **b. 50%**
- **c. 68%**
- **d. 95%**

14. An 8 bit ADC would output what binary value corresponding to -5?

- **a. 00000101**
- **b. 10000101**
- **c. 11111011**
- **d. 11111010**
- **e. none of the above**

256	128	64	32	16	8	4	2	1

15. To find the 95% confidence interval of the mean value of a very large normally distributed data set with 5,000 points you would use the equation (T/F):

$$x' = \overline{x} \pm t_{4999,95\%}\, S_{\overline{x}}$$

16. A very small, very sensitive thermocouple will reach a steady state temperature reading faster for a small step input than a large step input. (T/F)

17. As the number of data points increases the standard deviation of the means, $S_{\overline{x}}$, will also increase. (T/F)

18. The dynamic response of a first order sensor will tend to:

- **a. attenuate higher frequencies more than lower ones.**
- **b. overshoot the actual signal in response to a step input.**
- **c. be linear.**
- **d. none of the above.**

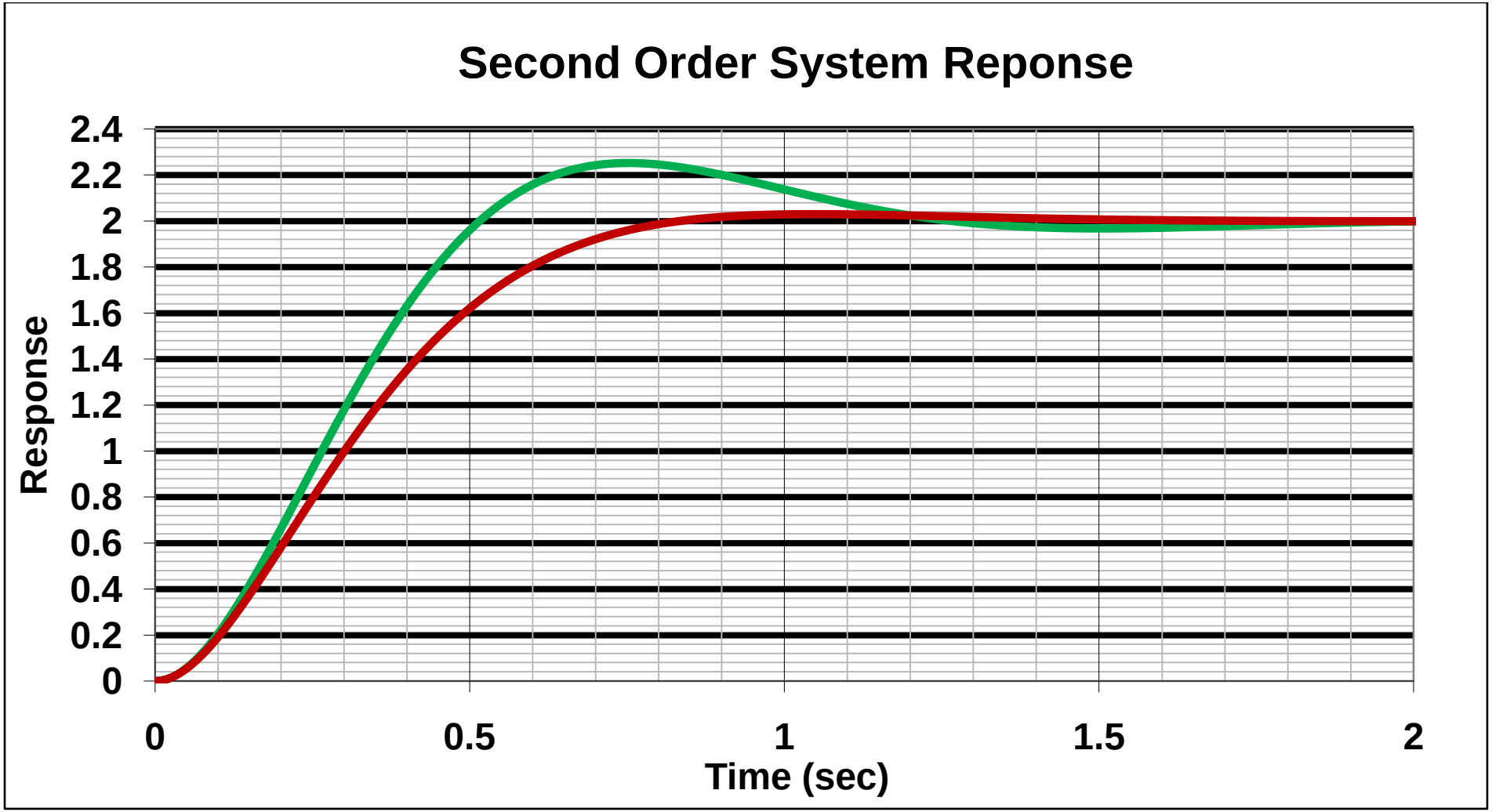
19. Given the data set in the table to the right, how many degrees of freedom, ν, are there in the standard deviation?

- **a. 17**
- **b. 18**
- **c. 19**
- **d. 20**

20. The uncertainty in the mean value could be reduced in this data set by:

- **a. decreasing the sensitivity of the measuring instrument**
- **b. increasing the number of measurements**
- **c. improving the precision of the measuring instrument**
- **d. all of the above**
- **e. both (b) and (c) are correct**

Sample of Random Variable x with a mean of 1.02 and a standard deviation of 0.158			
i	x_i	i	x_i
1	0.98000	11	1.0200
2	1.0700	12	1.2600
3	0.86000	13	1.0800
4	1.1600	14	1.0200
5	0.96000	15	0.94000
6	0.68000	16	1.1100
7	1.3400	17	0.99000
8	1.0400	18	0.78000
9	1.2100	19	1.0600
10	0.86000	20	0.96000



21. In the above figure which system has the shortest settling time?
    a. Red
    b. Green
22. In the above figure which system has the largest damping ratio?
    a. Red
    b. Green