

# EE361 Microcomputer-Based Digital Design

## Quiz 5

OPEN BOOK, OPEN NOTES.

Name: \_\_\_\_\_

Section: \_\_\_\_\_

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**There is another problem on the back of this sheet.**

1. Thermal noise voltages have an average value of 0 V. We want to select a 5 % accurate standard resistor to create a thermal voltage for use in generating random numbers. We will operate this noise source at room temperature (25 °C).

You may recall that a normally distributed random variable with standard deviation  $\sigma$  will be within  $\pm\sigma$  of the mean value 68.27 % of the time and within  $\pm 3\sigma$  of the mean 99.73 % of the time.

If the bandwidth of the system is  $B = 1$  MHz, what value of resistance should we choose so that 99.73 % of the generated voltages fall within the range  $[-500 \mu\text{V}, +500 \mu\text{V}]$ ?

2. Suppose we have designed a Galois implementation of a linear feedback shift register to create 16-bit pseudorandom numbers. The polynomial underlying the implementation is  $x^{16} + x^{14} + x^9 + x^4$ .

Draw a schematic diagram for the register.

If the most recently generated random number was  $A3B7_{16}$ , what random number will be generated next?