BIOE: Biostatistics Course Fall 2017

Assignment 4

Due 2nd November

For plotting use Matplotlib and provide the code you used with the assignment.

1. Describe what is meant by a sampling distribution. The textbook by Diez has a definition of the sampling distribution in Chapter 4, find it.

2. In one sentence, describe what the standard error measures.

3. **GRADUATES ONLY** Derive the relationship for the standard error

4. A sample of 100 students has a mean height of 1.7 meters. If the standard deviation of the heights is 0.12 meters compute the standard error of the sample.

5. Another sample of students is examined and its mean height is found to be 1.68 meters. Would you consider this unusual or inline with the previous sample mean? Justify your answer.

6. Show that the following data set is probably not normally distributed, you can use Python to do any computations.

10, 2, 3, 40, 5, 6, 17

7. The diameter of a quantum dot determines the color it emits when irradiated with UV. The diameters of 200 quantum dots are measured. The mean diameter was found to be 3.75 nm with a standard error of 0.26 nm. Calculate the 99% confidence interval for the sample.

8. Another sample of quantum dots from a different lab was examined and it would found the sample had an average diameter was 4.0 nm. Is it likely that the new sample will emit a different or similar color to the initial sample?

9. **UNDERGRADUATES ONLY** A sample of T. rex thigh bones yields a mean of 82 cm and standard deviation of 10.

a) If one T. rex bone has a diameter of 90 cm and another with 95 cm, what is the probability of finding a new T. rex bone with a thigh diameter between 90 and 95 cm?

b) A new T. rex thigh bone is found in a dig in Montana, however it appears to be a smaller sized bone with a diameter of 60 cm. Other evidence suggests that this bone is from an non-diseased adult. Present evidence to suggest that this is in fact not a T. rex bone but could be a new smaller species of T. rex. If so, we could name the new species T. minutiae but we need good evidence to suggest we've found a new species.

10. Describe how the Poisson and exponential distributions are complementary in the kind of process they describe. Illustrate your answer with an example.

11. A chemical reaction has a rate, λ of 4.5 reactions per microsec per ml. Assuming that the time to reaction is exponentially distributed, compute the probability that the next reaction will occur within 0.1 microseconds. Show your workings.

12. Create a crib sheet for the midterm. Hand in the crib sheet at the end of the midterm. The sheet will be graded for completeness and organisation (handwriting will not be graded!). The crib sheet will be graded with a simple A, B, and C or fail is no sheet is handed in.