

MATH 615: Approaches to Quantitative Analysis in the Life Sciences

Quiz Topics Guide

You should review information on the following topics

- **Number types (integers, reals) and data types (continuous, counts, successes)**
- **The 'big three' probability distributions: Poisson, Binomial, Normal**

Know what kind of process they are based on, what their domains are (e.g., 'non-negative integers'), and what their parameters are.

- **The Central Limit Theorem**

What is it, and why is it useful?

- **Likelihood**

What is it, and *in general terms* how do you calculate it for a given dataset and statistical model? Understand that fitting a model to data usually means *maximizing likelihood*.

- **Least squares fitting**

Why this is the same as maximizing likelihood if errors are assumed to be Normal.

- **Sums of squares and R^2**

Know how R^2 is calculated and what it describes.

- **Population and samples**

Know the difference. Understand that statistics are needed in order to make an inference about a population, based on a sample (and are *not* needed if you measure the entire population).

- **Biased and unbiased estimators**

Understand why a calculated mean is an unbiased estimator of a population mean, but a calculated standard deviation is a biased *underestimate* of a population standard deviation.

- **The main three frameworks for inference: hypothesis testing, model choice and Bayesian**

I do not expect you (at this point) to be able to write a philosophical comparison, but you should be able to recognize and describe the origin and meaning of the following terms and parameters

- **Degrees of freedom**
 - **Mean square error and mean square model**
 - **The F statistic**
 - **p**
 - **AIC**
 - **Prior probability distribution**
 - **Posterior probability distribution**
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- **The difference between statistical significance, explanatory power, and biological significance**