This syllabus is a general representation of the course as previously offered and is subject to change.

BIOL 300 – Fundamentals of Biostatistics

General Course Syllabus (as of June 2019)

About the Course:

Course Description: Biol 300 is a course designed to introduce biology students to thinking and doing data analysis using statistics.

Course Format: The course consists of 3 lecture hours per week and a 2 hour tutorial. The tutorial focusses on learning the free statistical package R.
Credits: 3
Pre-requisites: Either (a) BIOL 121 and one of MATH 101, MATH 103, MATH 105, MATH 121; or (b) SCIE 001.

Course Learning Objectives:

By the end of the course, students should be familiar with the following topics:

Part A: Introduction to Statistics

- Statistics and samples (random sampling, population vs. sample, types of variables, frequency distributions).
- Displaying data (tables, bar graphs, histograms, contingency tables, mosaic plots, cumulative frequency distributions, scatter plots, principles of effective display).
- Describing data (mean, median, mode, standard deviation, quartiles, proportions).
- Estimating with uncertainty (sampling error, parameters vs. estimates, sampling distributions of estimates, standard error, confidence intervals).
- Probability (probability definitions, Venn diagrams, probability distributions, addition and multiplication rules, independent vs. dependent events, probability trees, conditional probability, Bayes' theorem).
- Hypothesis testing (null vs. alternative hypotheses, Type I and Type II errors, one-side vs. two-sided tests).

Part B: Proportions and Frequencies

- Analyzing proportions (binomial distribution and test, Agresti-Coull confidence interval).
- Fitting probability models to frequency data (random models: proportion, binomial, Poisson; Chi-squared goodness-of-fit test).
- Contingency analysis (Chi-squared contingency test, Fisher's exact test).

Part C: Comparing Numerical Values

- Normal distributions (standard normal distribution, normal distribution of sample means, central limit theorem, normal approximation of the binomial distribution).
- Inference for a normal population (*t*-distribution, confidence interval for the mean, one-sample *t*-test, estimating SD and variance of a normal population).
- Comparing two means (paired *t*-test, two-sample *t*-test, comparing variances).
- Handling violations of assumptions (deviations from normality, when to ignore violations, transformations, nonparametric tests: sign text, Wilcoxon signed-rank test, Mann-Whitney U-test).
- Designing experiments (reducing bias, reducing sampling error).
- Comparing means of more than two groups (ANOVA, planned vs. unplanned comparisons, fixed vs. random effects).

Part D: Regression and Correlation

- Correlation between numerical variables (correlation coefficient, testing null hypothesis of zero correlation, Spearman's rank correlation).
- Regression (linear regression, confidence intervals, testing hypothesis of zero slope, regression toward the mean, nonlinear regression).

Part E: Modern Statistical Methods

- Computer-intensive methods (simulation, randomization, bootstrapping).
- Likelihood (maximum likelihood estimation, log-likelihood ratio test).

Textbooks and Additional Resources:

The Analysis of Biological Data, by Whitlock and Schluter.

Grading Scheme:

The course grade is calculated as follows:

- Final 50%
- Mid-term 30%
- Homework 10% (or 20% if no lab reports during the term)
- Lab reports 10%

Schedule of Topics:

See Course Objectives above.

Course Policies:

Performance on the exams is expected to reflect the student's own work, not that of other people. University policy dictates stern penalties for those who copy the work of others or allow their own work to be copied. On assignments, it is acceptable to work in groups, but it is not acceptable for a student to copy another's work or to allow their work to be copied.

If students miss the midterm with a legitimate excuse (either by pre-arrangement or an acceptable medical emergency with doctor's note), no make-up midterm will be offered. The final exam grade will be used in place of the midterm in the final grade assessment.

University Policies:

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence.

UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom.

UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances.

UBC values academic honesty and students ae expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on the UBC Senate website.