

Zoology 631, Biometry — Fall 2014

Nature and aims of the course

The general approach taken in the course is well described by the title of the textbook: **Introduction to the Practice of Statistics**. The course is **introductory** in that it assumes no prior knowledge of statistics, and has a **practical** focus on the use of statistical methods in the process of conducting scientific research, rather than on the statistical theory.

The primary aim of the course is for the students to attain full understanding of these few core concepts:

- The logic of statistical inference, particularly the meaning and role of the “sampling distribution” of a statistic, and how this logic fits into the larger process of generating knowledge through scientific research.
- The importance of obtaining good data, and in particular the role of randomization in ensuring that data represent what they are intended to represent.
- The general process of selecting the statistical procedure(s) appropriate to the goals of the study and the characteristics of the data and the study design.

The intended ‘**Student Learning Outcomes**’ (SLOs) thus are that students can apply the preceding concepts in their research; within this course these abilities will be assessed by having students design studies for and analyze data arising from real-world situations presented to them.

We unavoidably will spend most of our time focussed on specific statistical procedures, and even more specific software implementation of them. After all, students do need to learn what actually to do with their data. Furthermore, encountering a variety of concrete examples is crucial to understanding the three general concepts above; the third one in particular requires learning the relative importance of the various assumptions of particular procedures and how to assess their validity.

The course is introductory in a second sense also: it does not pretend to teach you everything you will ever need to know about statistics, but instead aims to prepare you to continue learning as needed. **Both to properly use the basic tools taught in this course, and to be able to learn new ones as needed, you will need to understand the fundamental concepts.** I will do my best to help you reach this level of understanding.

Organizational details

Instructor: Andy Taylor

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Course web site: <http://www2.hawaii.edu/~taylor/zool631.htm>.

Course email list: zool631-1@lists.hawaii.edu

Text: Moore, McCabe & Craig, *Introduction to the Practice of Statistics* (8th ed.)
[earlier editions also can be used]

I also have a student Study Guide to the text, various software guides, and a variety of other introductory texts available for loan. Some of these may be available in the bookstore.

Prerequisites:

No prior knowledge of statistics or statistical software is assumed. You should be comfortable with algebra; calculus will not be used but the exposure to mathematical thinking provided by calculus would be helpful.

Computing:

You will need access to a computer with statistics software. If you already know well how to use a statistical program, you are free to use it. Otherwise, good choices are Minitab (PCs only; available inexpensively from www.e-academy.com) or JMP (PC or Mac; available inexpensively from the UH site license office <http://www.hawaii.edu/site/lic/sasjmp/>).

What we will do and how you will be graded:

- **Homework - 20%:**
Weekly assignments, mostly exercises from the text
- **Discussions - 40%:**
Most weeks we will discuss and analyze data sets which will be distributed in advance; some weeks we will discuss designs of studies. Discussions will also be used to address questions about lectures or homework, and to teach the use of software.
Write-ups will be due the Monday following the discussion.
Grading will be based on write-ups and both quantity and quality of participation in class.
- **Midterm Exam - 10%:**
In-class exam covering Chapters 2–6. Mid-October.
- **Final Exam - 30%:**
Take-home exam covering the entire course. Given out by 10 Dec., due no earlier than 17 Dec.
- **Study sessions (ungraded):** Kirill will hold weekly study sessions, at a time to be determined later (probably Fridays); these will focus on homework assignments.

Biometry – Tentative Lecture and Reading Schedule – 2014

		Lecture Topic	Reading
Aug.	25	Course Introduction	
	27	Exploring & displaying distributions of data	1.1-2
	29	Describing describing distributions	1.3
Sept.	1	<i>no class</i> (Labor Day)	
	3	boxplots; density curves	1.3-4
	5	the normal distributions	1.4
	8	Relationships scatterplots	2.1-2
	10	correlation	2.3
	12	regression	2.4-5
	15	residual plots	2,5
	17	transformations	2.2
	19	Study design causation; experiment vs observation	2.7, 3.1
	22	sampling distributions, bias, variability	3.4
	24	surveys	3.3
	26	"	3.3
	29	experiments	3.2
Oct.	1	Probability & probability	4.1,2,5
	3	Distributions random variables	4.3-4
	6	binomial distributions	5.2
	8	distributions of sample means	5.1
	10	Inference confidence intervals	6.1
	13	" ; hypothesis testing	" ; 6.2
	15	hypothesis testing	6.2
	17	Type I and II errors	6.4
	20	use & abuse of inference	6.3
	22	exam (tentative date)	
	22/23	1-sample pairing; t CI & t test (in discussions)	7.1
	24	sign & signed-rank tests	7.1, 15.2
	27	permutation tests	16.5
	29	bootstrapping; transformations; assumptions and power; which to use (continued in discussions)	16.1-4, 7.1
	31	2-sample 2-sample t CI & t test	7.2
Nov.	3	two-sample permutation test	16.5, 16.2
	5	rank sum test	15.1
	7	assessing assumptions; which to use	7.2
	10	ANOVA ANOVA model	12.1
	12	ANOVA table; F statistic	12.1
	14	contrasts	12.2
	17	multiple comparisons	12.2 & HO
	19	assessing assumptions; remedies and alternatives	12.1, 15.3
	21	Regression regression model and estimation	10.1
	24	confidence and prediction intervals	"
	26	correlation; assessing assumptions	10.2
	28	<i>no class</i> (Thanksgiving)	
Dec.	1	remedies and alternatives	10.1
	3	Proportions inference for proportions	8.1-2
	5	contingency tables	9.1-2
	8	"	"
	10	"	"

Final Exam: distributed 10 December, due 17 December