

CALIFORNIA STATE POLYTECHNIC UNIVERSITY
 BIO 211 Biometrics Tentative Schedule

BIOLOGICAL SCIENCES DEPARTMENT
 Fall 2009 Section 01
 Course Number 71354

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Office Hours: MWF 12:00-12:50; TuTh 1:00-1:50 (Subject to change - check web page: <http://www.csupomona.edu/~djmoriarty>)

Date	Topic	Reading [Omissions] - Zar 4th Edition	Reading [Omissions] - Zar 5th Edition
25-Sep	Introduction		
28-Sep	Hypothesis Testing	Test Pac pgs. 3-4	Test Pac pgs. 3-4
30-Sep	Analysis of Frequencies	Zar Ch. 22 [22.7-22.10]	Zar Ch. 22 [22.7-22.8]
2-Oct	Analysis of Frequencies	Zar Ch. 23 [23.7-23.9]	Zar Ch. 23 [23.7-23.8]
5-Oct	Analysis of Frequencies		
7-Oct	Analysis of Frequencies		
9-Oct	Central Limit Theorem	Test Pac pgs. 61-64	Test Pac pgs. 61-64
12-Oct	One-sample t -test	Zar Ch. 7 [7.6-7.14]	Zar Ch. 7 [7.7-7.16]
14-Oct	One-sample t -test		
16-Oct	One-tailed & Two-tailed Tests	Test Pac pgs. 13-15	Test Pac pgs. 13-15
19-Oct	Two-sample Tests	Zar Ch. 8 [8.8; 8.11-8.14]	Zar Ch. 8 [8.8; 8.12-8.15]
21-Oct	Two-sample t -test		
23-Oct	Mann-Whitney U Test		
26-Oct	Paired-sample Tests	Zar Ch. 9 [9.6-9.7]	Zar Ch. 9 [9.6]
28-Oct	Paired-sample Tests		
30-Oct	EXAM		

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Date	Topic	Reading [Omissions] - Zar 4th Edition	Reading [Omissions] - Zar 5th Edition
2-Nov	Multiple-sample Tests; One-factor ANOVA	Zar Ch. 10 [10.2-10.3; 10.5; 10.7-10.9]	Zar Ch. 10 [10.2-10.3; 10.5; 10.7-10.9]
4-Nov	One-factor ANOVA		
6-Nov	Kruskal-Wallis; Multiple Comparisons	Zar Ch. 11 [11.3; 11.5-11.9]	Zar Ch. 11 [11.2; 11.5-11.8]
9-Nov	Two-factor ANOVA - randomized block; interaction	Zar Ch. 12 [12.2; 12.5-12.11]; Test Pac pgs. 45-53	Zar Ch. 12 [12.2; 12.6-12.9]; Test Pac pgs. 45-53
11-Nov	HOLIDAY		
13-Nov	Two-factor ANOVA with replications		
16-Nov	Regression	Ch. 17 [17.4-17.11]	Ch. 17 [17.5-17.11]
18-Nov	Regression		
20-Nov	Regression		
23-Nov	Correlation	Ch. 19 [19.3-19.8; 19.10-19.14]	Ch. 19 [19.3-19.8; 19.10-19.14]
25-Nov	Correlation		
27-Nov	HOLIDAY		
30-Nov	ANCOVA	Test Pac pgs. 56-60	Test Pac pgs. 56-60
2-Dec	EXAM		
4-Dec	Review		

Final Exam: Wednesday, December 9, 2009, 9:10 am - 11:10 am. Final exam is comprehensive.

Students are responsible for any changes in this schedule which may be announced in class.

Bring Test Pac and textbook (Zar) to each class meeting.

Objectives - Biology is a quantitative science. Skills in the quantitative aspects of biology greatly enhance the employment prospects of the biology student. This course introduces the student to statistical methods commonly used in biology. Knowledge of biometrics will aid the student in understanding, interpreting, and judging published reports on biological research. For those students who will be engaging in basic research or applied science, biometrics is an indispensable tool.

Prerequisite - Basic Biology (the Foundations series BIO 121/L, 122/L, 123/L, or BIO 115) and an introductory college-level statistics course (e.g. STA 120) is highly recommended. Biometrics is dependent on a working knowledge of the material covered in introductory statistics. Students should take Biometrics within two quarters of completing introductory statistics, and that they complete introductory statistics with at least a C grade. Students lacking the basic statistics prerequisite are responsible for learning the necessary material. Material to learn and/or review basic statistics will be provided in the laboratory (BIO 211L).

Required Materials - All students are required to have the textbook: Zar, J.H. *Biostatistical Analysis*, 4th edition OR 5th edition. Both 4th and 5th will be supported, and either edition may be used. Student are also required to have the BIO 211 Test Pac. Text books and the Test Pac are available at the Bronco Bookstore. The BIO 211 Test Pac is also available free of charge on world wide web: <http://www.csupomona.edu/~djmoriarty/> Click the link to the Biometrics (BIO 211) home page. Note: The Test Pac file is available on the web in pdf format. Students are responsible for all aspects of downloading, handling, and printing the file, as well as for correcting any errors caused by platform conversions or font substitutions.

The BIO 211 Test Pac must be brought to each class meeting. The textbook contains over 150 pages of tables. It is important that you bring the book to lecture to learn the correct use of the tables. Answers to the problems at the end of each chapter are available.

Each student is required to have a calculator capable of addition, subtraction, multiplication, division, and square root.

Lecture Exams - Two hourly exams and a final will be administered. The final will be comprehensive, the hourly exams will not. Students must take exams with the section in which they are enrolled. Each of the two hourly exams will be worth 100 points. The final exam will be worth 120 points. No extra credit projects are allowed. Exams must be taken at the scheduled time. No early or make-up exams are allowed. Missed exams will be scored as a zero (0). There are no exceptions to this policy.

Exams will consist of two parts. Part one will be closed book and consist of multiple choice questions dealing with definitions and concepts. Scantron form 882 and a #2 pencil are required for the closed book sections of all exams. When part one is completed and handed in, part two will be handed out. Any books or notes may be used on part two of the exam, which will consist of solving problems. Answers to problems in part two must include methods of calculation and intermediate values to allow the grading of procedure. Answers without methods and intermediate values will receive no credit. Exams will not be returned to students. Students may not remove exam materials from the classroom under any circumstances; this will be considered theft of university property.

Scores on all exams and the final course grade will be made available to students via the Blackboard system:
<https://blackboard.csupomona.edu/webapps/login>

Attendance - Attendance is required on days of scheduled hourly and final exams. By enrolling in this course, you are agreeing to take the exams as scheduled.

Behavior – Students must not engage in disruptive, disrespectful behaviors such as talking, passing notes, eating, entering or leaving while class is in session. Students may not use computers during the lecture unless approved by the DRC or other appropriate campus authority. Individuals engaging in disruptive behaviors will be excluded from the class without prior notice per university policy. See the current version of the University Catalog. Check the index under “Exclusion of Students from Classes.”

Calculator/Computer policy - Each student must have a calculator capable of addition, subtraction, multiplication, division, and square root. Any type of calculator, including statistical calculators, programmable calculators, and graphing calculators will be allowed only on part two (open book) of the exams. Laptop or notebook computers are not allowed. Definition of a computer vs. a calculator is at the discretion of the instructor.

Laboratory - Attendance at the laboratory sessions is very strongly recommended. The laboratory is devoted to exercises in analytical thinking and problem solving that are tested on the lecture exams, with the intent of improving student performance on these exams. Some material appearing on the lecture exams may only be discussed in the laboratory. Student performance in the laboratory can not lower (but can raise) a student’s letter grade in BIO 211 and BIO 211L. Please refer to the Grading and Grading: Hypothetical Example parts of this document for further information.

Academic Integrity - Cheating and plagiarism are violations of university policy and are considered serious offenses. The Department of Biological Sciences takes all incidences of academic dishonesty seriously and acts accordingly.

Grading - Students will receive the same grade for lecture (BIO 211) and laboratory (BIO 211L). This grade is determined by the lecture instructor.

In lecture, 2 hourly exams (100 points each) and a final exam (120 points) will be administered for 320 total points. The lab will be worth 100 points. Lecture and lab combined therefore have 420 points.

Students will have a lecture percentage calculated (i.e. percentage of 320), as well as a percentage based on lecture and lab (i.e. percentage of 420). Grades for *both* lecture (BIO 211) and lab (BIO 211L) will be assigned using the *higher* of the two percentages.

A curve may be established at the discretion of the instructor. The following guarantees are made, regardless of any curve: 90% or above is an A; 80% or above is at least a B; 70% or above is at least a C; 60% or above is at least a D.

Grading: Hypothetical Example - All percentages discussed below are rounded to the nearest whole percent.

Consider the following **hypothetical** example. Based on performance of all students, the following grading scale is determined:

90 - 100%:	A
80 - 89%:	B
70 - 79%:	C
60 - 69%:	D
0 - 59%:	F

Further consider four hypothetical students. Student 1 did not attend the lab; students 2, 3, and 4 did the lab work. Their exam/lab scores and grades earned are:

Student	1	2	3	4
Hourly 1	91	91	93	61
Hourly 2	87	87	89	64
Final	106	106	105	75
Total	284	284	287	200
% of 320	89%	89%	90%	63%
Lab Total	0	92	70	92
% of 420	68%	90%	85%	70%
Grade	B	A	A	C

Student 1 receives a B in BIO 211 and BIO 211L.

Students 2 and 3 receive an A in BIO 211 and BIO 211L.

Student 4 receives a C in BIO 211 and BIO 211L.

Concurrent Enrollment Required (Lecture and Lab) - You **MUST** take both Lecture and Lab together (same quarter).

- The grade for Lecture and Lab is determined by Lecture instructor
- If you take only Lecture, you won't get a grade for Lab. You will have to repeat BOTH Lecture and Lab
- If you take only Lab, you won't get a grade for Lecture and will get a WU for Lab. (WU counted as an F in your GPA). You will have to repeat BOTH Lecture and Lab
- Even if you are repeating the class, you **MUST** take BOTH Lecture and Lab

Access to Laboratory Materials - Under no circumstances will quizzes or any other laboratory materials be made available to students who fail to attend lab sessions. Students must attend the laboratory section in which they are enrolled.

Practice Problems for Exams – The BIO 211 Test Pac has two practice exams for the first hourly (Practice Exams 1A and 1B), and two practice exams for the second hourly (Practice Exams 2A and 2B). These practice exams are only for the open book portion of the exams, not for the multiple choice section.

In addition, practice problems for the open book portions of both hourly exams and the final may be found on the web at the BIO 211 home page: <http://www.csupomona.edu/~djmoriarty/> Click the link to the Biometrics (BIO 211) home page.

BIO 211 Test Pac - Corrections to version 12

If you purchased your TestPac at the bookstore, make sure you make these corrections.

If you downloaded your TestPac, these corrections may have already been made before you downloaded. However, check your copy to be sure.

Page 6

In the calculation of the expected frequencies, the total sample size was shown as 256. This is not correct. The total sample size is 556. The corrected text appears below:

Note that expected frequencies are calculated by multiplying the expected proportion times the total sample size. In this example:

Yellow, Round: $9/16 \times 556 = 312.75$
 Yellow, wrinkled: $3/16 \times 556 = 104.25$
 green, Round: $3/16 \times 556 = 104.25$
 green, wrinkled: $1/16 \times 556 = 34.75$

BIO 211 Biometrics Table of Page Number Equivalencies - Zar 4th and 5th editions

	Zar - 4 th Edition	Zar - 5 th Edition
Statistical Tables		
B.1 Critical values of the Chi-Square Distribution	App12	673
B.2 Proportions of the Normal Curve (One-Tailed)	App17	676
B.3 Critical values of the <i>t</i> Distribution	App19	678
B.4 Critical values of the <i>F</i> Distribution	App21	680
B.11 Critical values of the Mann-Whitney <i>U</i> Distribution	App89	747
B.12 Critical values of the Wilcoxon <i>T</i> Distribution	App101	758
B.17 Critical values of the Correlation Coefficient, <i>r</i>	App109	766
B.20 Critical values of the Spearman Rank Correlation Coefficient, <i>r_s</i>	App116	773
Chapters (see syllabus for exact reading assignment)		
22 Testing for Goodness of Fit	461	466
23 Contingency Tables	486	490
7 One-Sample Hypotheses	91	97
8 Two-Sample Hypotheses	122	130
9 Paired-Sample Hypotheses	161	179
10 Multisample Hypotheses - the Analysis of Variance	177	189
11 Multiple Comparisons	208	226
12 Two-Factor Analysis of Variance	231	249
17 Simple Linear Regression	324	328
19 Simple Linear Correlation	377	379

Data = numerical facts

Statistic = estimate of a population parameter

Population parameter = numerical feature

Population is defined biologically

Estimate means a “guess” – not the correct value

Values for population parameters can never be known:

Populations are too big and dynamic

Therefore, we estimate a parameter from a random sample

Random sample = representative of the population with respect to the variable being estimated

All sample estimates (statistics) are “wrong”; they are guesses

Sampling error (sample error) refers to the fact that any sample estimate is a guess.

A statistic will never be exactly equal to the population parameter it is estimating

Biologists need to make conclusions at the population level

Biologists have to work at the sample level

In order to make conclusions at the population level using sample estimates, you must deal with sampling error

Statistics (statistical tests) are tools that allow biologists to handle sampling error in an objective manner

Statistical tests allow biologists to make conclusions about population parameters using sample estimates

The conclusions are based on probability, that is, what is the probability a conclusion is correct or incorrect

Inferential statistical tests are used to make a conclusion at the population level, using data at the sample level

All statistical tests have a common approach to reaching these conclusions. The details can be very different in different tests, but the general approach is always the same.