COURSE OUTLINE OF RECORD

Number: BIOL G260  TITLE: Biostatistics

ORIGINATOR: Travis Vail  EFF TERM: Fall 2016
FORMERLY KNOWN AS:  DATE OF OUTLINE/REVIEW: 04-05-2016
CROSS LISTED COURSE:  TOP NO: 0499.00

SEMESTER UNITS: 3.0  CID:
HRS LEC: 36.0  CONTACT HRS TOTAL: 90.0
HRS LAB: 54.0  STUDY NON-CONTACT HRS RECOMMENDED: 72.0
HRS OTHER: 0.0

CATALOG DESCRIPTION:
Biostatistics introduces students to data analysis and experimental design. This course specifically focuses on the nature, generation, and testing of biological data. Analyses learned include, but are not limited to, one-sample t-test, two-sample t-test (both pooled and unpooled), variance ratio test, 1-way ANOVA, 2-way ANOVA with replication, block design ANOVA, Tukey's test of pairwise comparisons, chi-squared tests, and non-parametric tests.

JUSTIFICATION FOR COURSE:

PREREQUISITES:
- BIOL G180: Cell and Molecular Biology with a minimum grade of c or better
- BIOL G186: Diversity of Organisms with a minimum grade of c or better
- BIOL G182: Zoology with a minimum grade of c or better
- BIOL G210: General Microbiology with a minimum grade of c or better
- MATH G120: Trigonometry
- MATH G170: Precalculus with a minimum grade of c or better
- MATH G180: Calculus 1 with a minimum grade of c or better

COREQUISITES:

ADVISORIES:

ASSIGNED DISCIPLINES:
- Biological sciences

MATERIAL FEE: Yes [ ] No [X] Amount: $0.00

CREDIT STATUS: Noncredit [ ] Credit - Degree Applicable [X] Credit - Not Degree Applicable [ ]

GRADING POLICY: Pass/No Pass [ ] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]

OPEN ENTRY/OPEN EXIT: Yes [ ] No [X]

TRANSFER STATUS: CSU Transferable[ ] UC/CSU Transferable[X] Not Transferable[ ]

BASIC SKILLS STATUS: Yes [ ] No [X]  LEVELS BELOW TRANSFER: Not Applicable

CALIFORNIA CLASSIFICATION CODES: Y - Not Applicable

NON CREDIT COURSE CATEGORY: Y - Not applicable, Credit Course
BIOL G260-Biostatistics

OCCUPATIONAL (SAM) CODE:
REPEATABLE ACCORDING TO STATE GUIDELINES: No [X] Yes [ ] NUMBER REPEATS:
REQUIRED FOR DEGREE OR CERTIFICATE: No [X] Yes [ ]

GE AND TRANSFER REQUIREMENTS MET:
CSU GE Area B: Scientific Inquiry and Quantitative Reasoning
   B2 - Life Science
   B4 - Mathematics/Quantitative Thinking
GWC AA - Area E Lifelong Understanding and Self-Development
   Area E Lifelong Understanding and Self-Development

COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:

1. Compose a scientific paper using the appropriate standards for scientific writing.
2. Design a scientifically sound experiment that generates analyzable data.
3. Analyze any data set encountered using the appropriate statistical analysis.
4. Interpret results of statistical analyses and discuss the implications of such results on the biological system examined.

COURSE OBJECTIVES:
1. Design a scientifically sound experiment that generates analyzable data.
2. Analyze any data set encountered using the appropriate statistical analysis.
3. Interpret results of statistical analyses and discuss the implications of such results on the biological system examined.
4. Compose a scientific paper using the appropriate standards for scientific writing.

COURSE CONTENT:

LECTURE CONTENT:
I. Definition of Biostatistics
II. Describing data types
   Commonly used terms
   Types of data
III. Experimental design
   Scientific method
   Control vs experimental groups
      Isolating variables
   Clinical vs. Observation experiments
   Designing with analysis in mind
IV. Describing data sets
   Frequency distributions
   Measures of center, variation, and relative standing
V. Probability
Addition rule
Multiplication rule

VI. Discrete probability distributions
   Binomial distribution and its parameters
   Poisson distribution and its parameters

V. Normal probability distributions
   Standard normal distribution
   Central Limit Theorem

VI. z-scores and t-scores

VII. One sample hypothesis testing
   Null and alternative hypotheses
   One-sample z tests
   One-sample t tests

VIII. Two-sample hypothesis testing
   Variance ratio hypothesis testing
   Two sample t’ hypothesis testing
   Two sample t hypothesis testing

IX. Correlation and regression

X. Chi-square hypothesis testing
   Test of goodness-of-fit
   Test of independence
   Test of homogeneity

XI. Analysis of Variance
   Why it works.
   Variance ratio test
   1-way ANOVA
      Tukey’s test
   2-way ANOVA with replication
      Tukey’s test
   2-way ANOVA without replication (block design)

XII. Non-parametric analyses
   Sign-ratio test
   Wilcoxon signed-rank tests
   Kruskal-Wallis test
Rank Correlation

XIII. Deciding when test hypothesis test is appropriate

LABORATORY CONTENT:

I. Parameters and statistics
II. Use of the summation notation
III. Probability: Poisson and binomial distributions
IV. Probability: normal distribution
V. \( z \)-scores, \( t \)-scores, and standard normal distribution
VI. Experimental design
VII. Hypothesis testing
   Null and alternate hypotheses
   One-sample \( t \) and \( z \) tests
   Variance ratio test
   Two-sample \( t \), \( t' \), and \( z \) tests
   One-way ANOVA
      Fmax test
      Tukey’s test
   Two-way ANOVA
      Randomized block design
      With replication
         Fmax test
         Tukey's test
   Chi-square analyses
      Goodness-of-fit
      Homogeneity
      Independence
   Non-parametrics

METHODS OF INSTRUCTION:
A. Lecture:
B. Lab:

INSTRUCTIONAL TECHNIQUES:
Lecture, hands-on lab work, assigned reading.
COURSE ASSIGNMENTS:

Reading Assignments
Textbook reading (as assigned on the course syllabus), reading of peer-review journal in preparation for experimental design.

Out-of-class Assignments
Student experiment project, problem sets completed at home

Writing Assignments
Scientific paper covering student experiments

METHODS OF STUDENT EVALUATION:
Written Assignments
Essay Examinations
Objective Examinations
Report
Projects (ind/group)
Problem Solving Exercises
Oral Presentations

Demonstration of Critical Thinking:
Application of results of statistical analyses

Required Writing, Problem Solving, Skills Demonstration:
Scientific written and oral reports regarding student-generated experiment, data, and results.

TEXTS, READINGS, AND RESOURCES:
TextBooks:

LIBRARY:
Adequate library resources include: Print Materials
Non-Print Materials
Online Materials
Services

Comments:
An expansion of subscribed scientific journals would help students in preliminary research prior to design of their experiment.

Attachments:
Attached Files