Kingsborough Community College
The City University of New York
Department of Biological Sciences and Department of Mathematics

BIO9100 01 (58263) and MAT9100 01 (19183)

Biostatistics

Course Syllabus - Spring 2021

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Office hours: Mon 10-11a (via Zoom) and Wed 10a-12p (via on-line email)
All communication must be via KBCC student email address only.

BIO/MAT 9100 - Biostatistics course description

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4 Credit(s)4 hrs. Hours
Cross-Listed With: **MAT 9100**
An introduction to the theories and techniques relating to probability, statistics and data analysis as pertaining to biology. Discrete and continuous probability distributions are studied including binomial, normal and t-distributions. Classical and Bayesian statistics, estimation, hypothesis testing will be emphasized. SPSS software will be introduced and used in the laboratory achievements.
Prerequisite(s): A passing score on the ACCUPLACER CUNY Assessment Test in Math **or** completion of developmental mathematics **and** BIO 1300 **or** BIO 3300 **or** Department permission
Required Core: Mathematical and Quantitative Reasoning
Flexible Core: Scientific World (Group E)

Required Texts:

1. BIO9100/MAT9100 Custom Combined OpenStax Biostatistics and Online Statistics Education: A Multimedia Course of Study book available free of charge in Blackboard.

Course Outcomes

1. Calculate measures of central tendency using biological data.
2. Apply the principles and techniques of probability to solve problems in the biological sciences.
3. Select the appropriate inferential test to statistically analyze biological data.
4. Perform an inferential test on biological data.
5. Critique the statistics presented in an article from a scientific journal.

Civility Statement

As an institution of higher education, Kingsborough Community College and its faculty and staff are committed to its entire student body. As such, we strive to interact with each student equitably and professionally while providing an environment of mutual respect and civility. In the event a student has an allegation charge brought against him/her that is a breach of the Henderson Rules to Maintain Public Order or the Campus Code of Conduct, an immediate investigation will commence followed by a conciliation conference to determine the appropriate outcome within a thirty day period. The Judicial Affairs process at Kingsborough Community College is critical in providing an agenda for safety, yet simultaneously offering protection of the rights of students who may have been accused of being in violation of the Henderson Rules to Maintain Public Order and/or the Campus Code of Conduct. These rights have been afforded to each Kingsborough student under the bylaws that were established in 1969.

COURSE TOPICS AND SEQUENCE

Week	Topics	Textbook Chapter
1	Sampling and Data	**1**
	1.1 Definitions of Statistics, Probability, and key Terms	
	1.2 Data, Sampling, and Variation in Data and Sampling	
	1.3 Frequency, Frequency Tables, and Levels of Measurement	
	1.4 Experimental design and Ethics	
2	Descriptive Statistics	**2**
	2.1 Line Graphs and Bar Graphs	
	2.2 Histograms, Frequency Polygons, and Time Series Graphs	
	2.3 Measure of the Location of the Data (Relative Standing)	
	2.5 Measures of the Center of the Data	
	2.6 Skewness and the Mean, Median and Mode	
	2.7 Measures of the Spread of the Data	
3	Probability Topics	**3**
	3.1 Terminology	
	3.2 Independent and Mutually exclusive Events	
	3.3 Two Basic Rules of Probability	
	3.4 Contingency Tables	
	3.5 Mortality, Fertility and Morbidity Rates	
4	Discrete Random Variables	**4**
	4.1 Probability Distribution Function (PDF) for a Discrete Random Variable	
	4.2 Mean or Expected Value and Standard Deviation	
	4.3 Binomial Distribution	
	4.6 Poisson Distribution	
5	Continuous Random Variables	**5**
	5.1 Introduction and Continuous Probability Functions	
	The Normal Distribution	**6**
	6.1 The Standard Normal Distribution	
	6.2 Using the Normal Distribution	
	The Central Limit Theorem	**7**
	7.1 The Central Limit Theorem for Sample Means (Averages)	
	7.3 Using the Central Limit Theorem	
6	Confidence Intervals	**8**
	8.1 A Single Population Mean using the Normal Distribution	
	8.2 A Single Population Mean using the Student t Distribution	
	8.3 A Population Proportion	

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COURSE TOPICS AND SEQUENCE - CONTINUED

Week	Topics	Textbook Chapter
7	Hypothesis Testing with One Sample	**9**
	9.1 Null and Alternative Hypotheses	
	9.2 Outcomes and the Type I and Type II Errors	
	9.3 Distribution Needed for Hypothesis Testing	
	9.4 Rare Events, the Sample, Decision and Conclusion	
	9.5 Additional Information and Full Hypothesis Test Examples	
8	Hypothesis Testing with Two Samples	**10**
	10.1 Two Population Means with Unknown Standard Deviations	
	10.2 Two Population Means with Known Standard Deviations	
	10.3 Comparing Two Independent Population Proportions	
	10.4 Matched or Paired Samples	
9	The Chi-Square Distribution	**11**
	11.1 Facts About the Chi-Square Distribution	
	11.2 Goodness-of-Fit Test	
	11.3 Test of Independence	
	11.4 Test for Homogeneity	
	11.5 Comparison of the Chi-Square Tests	
	11.6 Test of a Single Variance	
10	Linear Regression and Correlation	**12**
	12.1 Linear Equations	
	12.2 Scatter Plots	
	12.3 The Regression Equation and Correlation	
	12.5 Prediction	
11	F Distribution and One-Way ANOVA	**13**
	13.1 One-Way ANOVA	
	13.2 The F Distribution and the F-Ratio	
	13.3 Facts About the F Distribution	
	13.4 Test of Two Variances	
12	Distribution Free (Nonparametric) Tests	**XVIII**
	A. Benefits of Distribution-Free Tests	
	C1. Mann-Whitney U, Wilcoxon Rank-Sum Test	
	C2. Kruskal-Wallis Test (H-Test)	

Attendance Policy and INC Grades

Students who stop participating in the class by not submitting items for grading, will earn a failing final grade. INC is only assigned if a student is passing the class and can pass the class if they take the final. All college policies regarding attendance and grades will be adhered to.

Accessibility

Access-Ability Services (AAS) serves as a liaison and resource to the KCC community regarding disability issues, promotes equal access to all KCC programs and activities, and makes every reasonable effort to provide appropriate accommodations and assistance to students with disabilities. Please contact this office if you require such accommodations and assistance. Your instructor will be glad to make the accommodations you need, but you must have documentation from the Access-Ability office for any accommodations.

Grading

1. Exams - Three (3) lecture exams will be given on the dates indicated on the tentative schedule via BlackBoard. Instructions will be provided via announcement and email. Each exam will be graded on a scale of 100 points. No make-ups will be given. A missed exam counts as a zero for that exam. However, the lowest exam grade will be dropped at the end of the semester. The two (2) highest exam grades will be counted and each will comprise 15% (total = 30%) of your final grade. The use of calculators or any electronic device on exams is prohibited. All formulas must be committed to memory for exams; formulas will not be provided on exams. You will be on your honor during exams.
2. Assignment – One (1) Assignment will be given this semester and is due on the date indicated on the tentative schedule via File Exchange on BlackBoard. The Assignment will be graded on a scale of 100 points. Failure to submit the Assignment will result in a grade of zero for the Assignment. For each week or part the Assignment is late, 10 points will be deducted from your grade on the Assignment. The Assignment comprises 20% of your final grade.
3. Computer Lab Research Project – A Computer Lab Research Project will be required this semester. It will be due as indicated on the calendar and will be graded on a scale of 100 points. Failure to submit the project will result in a grade of zero for the project. For each week or part, a piece or the final project is late, 5 points will be deducted from your grade on that part/project. The Computer Lab Research Project comprises 30% of your final grade. This will be submitted as a MS Word document via File Exchange on Blackboard to the professor.
4. Final Exam – The final exam is cumulative and comprises 20% of your final grade. More details will follow on the final exam. The use of calculators or any electronic device on the final exam is prohibited. All formulas must be committed to memory for the final exam; they will not be provided.

Grade Summary

Exams	30%	
Assignment	20%	
Computer Lab Research Project	30%	
Final Exam	20%	
Total	100%	Passing is ≥ 60%.

Note: The grade on the Assignment and the Computer Lab Research Project will be reduced by 10% for each week or part that it is submitted late.

Academic Integrity Policy

Kingsborough Community College strives to promote academic integrity among students to help prepare them for their future endeavors. The International Center for Academic Integrity defines academic integrity by 5 core values. These values are as follows:

1. **Honesty:** The quest for truth and knowledge by requiring intellectual and personal honesty in learning, teaching, research, and service
2. **Trust:** Academic institutions must foster a climate of mutual trust in order to stimulate the free exchange of ideas.
3. **Fairness:** All interactions among students, faculty and administrators should be grounded in clear standards, practices and procedures.
4. **Respect:** Learning is acknowledged as a participatory process, and a wide range of opinions and ideas is respected.
5. **Responsibility:** A thriving community demands personal accountability on the part of all members and depends upon action in the face of wrongdoing.

To reach academic success, one needs to uphold the 5 core values of honesty, trust, fairness, respect and responsibility. Failure to do so may result in charges of academic dishonesty. Academic dishonesty is prohibited by CUNY and Kingsborough Community College and is punishable by penalties, including failing grades, suspension, and expulsion. Examples of academic dishonesty include, but are not limited to, cheating, plagiarism, internet plagiarism, obtaining unfair advantages, and falsification of records. For further detail, see the KCC website:
https://www.kbcc.cuny.edu/studentaffairs/student_conduct/Pages/academic_integrity.aspx

BIO/MAT9100 – BIOSTATISTICS - TENTATIVE SCHEDULE - SPRING 2021

Week	Start Date	Notes
1	3/08	Class begins
2	3/15	
3	3/22	
-	3/27 – 4/4	No Classes – Spring Break
4	4/05	Classes resume **Mon 4/5 Exam 1 via BlackBoard**
5	4/12	
6	4/19	
7	4/26	**Mon 4/26 Exam 2 via BlackBoard**
8	5/03	
9	5/10	**Mon 5/10 Assignment due 2pm via File Exchange on BlackBoard**
10	5/17	**Fri 5/21 Computer Research Project Due via File Exchange on Blackboard**
11	5/24	**Mon 4/26 Exam 3 via BlackBoard**
12	6/01	(Mon 5/31 College Closed)
13	6/07	Mon 6/7 = Last Day of Class Tue 6/8 = Reading Day

*** Wed 6/9 – Tue 6/15 – **Finals** – Day, Date, Time TBA***

Student Objectives

Ch. 1 – Sampling and Data

- Define: data, statistics, population, sample, parameter, statistic, qualitative, quantitative, discrete, continuous.
- Distinguish between sample and population, parameter and statistic, a retrospective and prospective study, a single and double blind study.
- Define: observation study, experiment, clinical trial, treatment group, control group, cross-sectional study, retrospective and prospective study, placebo effect, blinding, single and double blinded study, randomization, replication, error.
- Provide an example of systematic, convenience, stratified and cluster sampling.

Ch.2 – Descriptive Statistics

- Define: frequency distribution, histogram.
- Construct a frequency distribution for biological data.
- Construct a histogram, pie chart, time-series graph.
- Define: mean, median, mode, midrange, skewness.
- Calculate a mean, median, mode, midrange for a set of biological data.
- Define: range, standard deviation, and variance.
- Calculate the range, standard deviation and variance for a set of biological data.
- State and use Chebyshev's Theorem.
- Define: standard *z* score, quartile, and percentile.
- Calculate a standard z score for a set of biological data.
- Determine the quartiles and percentiles for a set of biological data.

Ch. 3 – Probability Topics

- Define: prevalence, event, probability, mutually exclusive, independent, and dependent.
- Calculate the probability of a biological event.
- State and use the Addition Rule for probability using biological data.
- State and use the Rule of Complementary Events for probability using biological data.
- State and use the Multiplication Rule for probability using biological data.
- Define Conditional Probability.
- Define and calculate rate, mortality rate, fertility rate, morbidity rate for a population.

Ch. 4 – Discrete Random Variables

- Define: random variable, probability distribution, discrete random variable, binomial probability distribution.
- Analyze a probability distribution for a set of biological data.
- Determine whether a set of biological data meet the requirements for a binomial distribution.
- Determine the mean, variance and standard deviation for the binomial distribution of a set of biological data.
- Define and use the Poisson Distribution for a set of biological data.

Ch. 5 – Continuous Random Variables

- Define: continuous random variable

Ch. 6 – The Normal Distribution

- Define: normal distribution, uniform distribution, standard normal distribution.
- Analyze the normal distribution for a set of biological data.

Ch. 7 – The Central Limit Theorem

- State the Central Limit Theorem.
- Apply the Central Limit Theorem to a set of biological data.
- Use the Normal Distribution as an approximation to the Binomial Distribution on a set of biological data.

Ch. 8 – Confidence Intervals

- Distinguish between proportion, probability and percent.
- Define: confidence interval.

- Determine the confidence interval for a set of biological data.
- Estimate a population mean with standard deviation known.
- Estimate a population mean with standard deviation unknown.

Ch. 9 – Hypothesis Testing with One Sample

- Define: hypothesis, hypothesis test.
- Given a claim, state the null and alternative hypothesis.
- Given a claim and biological data, calculate the test statistic.
- Identify the Critical and P-Values for a set of biological data.
- State the conclusion of a hypothesis test on a set of biological data.
- Identify potential errors when testing a claim about biological data.
- Test a claim about a proportion.
- Test a claim about a mean with standard deviation known.
- Test a claim about a mean with standard deviation unknown (t-Test).

Ch. 10 – Hypothesis Testing with Two Samples

- Use a test statistic to compare two population proportions.
- Perform a t-Test on two means with independent samples.
- Perform a t-Test on matched pairs of biological data.
- Perform an F-Test on a set of biological data.

Ch. 11 – The Chi-Square

- Estimate a population variance.
- Test a claim about a standard deviation or variance.
- Test for Independence or Homogeneity

Ch. 12 – Linear Regression and Correlation

- Define: correlation, scatterplot, linear correlation coefficient (Pearson Coefficient), regression.
- Perform a correlation on a set of biological data.
- Perform a regression on a set of biological data.

Ch. 13 – F Distribution and One-Way ANOVA

- Define ANOVA.
- Perform a One-Way ANOVA on a set of biological data.

Ch. XVIII – Distribution Free (Nonparametric) Tests

- Define: parametric test, nonparametric test, Wilcoxon Rank-Sum Test, Kruskal-Wallis Test (H Test).
- Perform a Wilcoxon Rank-Sum Test on a set of biological data.
- Perform a Kruskal-Wallis Test (H Test) on a set of biological data.