General Education Introductory Statistics

Course Description:
General Education Introductory Statistics is a course that stresses statistical literacy with conceptual understanding, relevance, and interpretation of key statistical processes. Correct use of vocabulary is imperative. Students should recognize the importance of data collection with proper sampling, experimental design, and identification of possible errors. At a minimum, a scientific calculator should be used to aid computation.

In the era of co-requisite mathematics courses and alternative pathways, a General Education Introductory Statistics course may be an appropriate mathematics course for some majors. A transferrable course should meet the guidelines set by the American Statistical Association (ASA) in the revised Guidelines for Assessment and Instruction in Statistics Education (GAISE) College Report (2016). [1]

From GAISE Revised College Report (Page 3) [1]
"The revised recommendations are:

1. Teach statistical thinking.
    - Teach statistics as an investigative process of problem-solving and decision-making.
    - Give students experience with multivariable thinking.
2. Focus on conceptual understanding.
3. Integrate real data with a context and purpose.
4. Foster active learning.
5. Use technology to explore concepts and analyze data.
6. Use assessments to improve and evaluate student learning."

From GAISE Revised College Report 2016 (Page 8) [1]
"The desired result of all introductory statistics courses is to produce statistically educated students, which means that students should develop the ability to think statistically.

The following goals reflect major strands in the collective thinking expressed in the statistics education literature. They summarize what a student should know and understand at the conclusion of a first course in statistics. Achieving this knowledge will require learning some statistical techniques, but mastering specific techniques is not as important as understanding the statistical concepts and principles that underlie such techniques. Therefore, we are not recommending specific topical coverage.

1. Students should become critical consumers of statistically-based results reported in popular media, recognizing whether reported results reasonably follow from the study and analysis conducted.
2. Students should be able to recognize questions for which the investigative process in statistics would be useful and should be able to answer questions using the investigative process.
3. Students should be able to produce graphical displays and numerical summaries and interpret what graphs do and do not reveal.
4. Students should recognize and be able to explain the central role of variability in the field of statistics.
5. Students should recognize and be able to explain the central role of randomness in designing studies and drawing conclusions.
6. Students should gain experience with how statistical models, including multivariable models, are used.
7. Students should demonstrate an understanding of, and ability to use, basic ideas of statistical inference, both hypothesis tests and interval estimation, in a variety of settings.
8. Students should be able to interpret and draw conclusions from standard output from statistical software packages.
9. Students should demonstrate an awareness of ethical issues associated with sound statistical practice."

[1] Citation: GAISE College Report ASA Revision Committee, "Guidelines for Assessment and Instruction in Statistics Education College Report 2016," http://www.amstat.org/asa/files/pdfs/GAISE/GaiseCollege_Full.pdf

Course objectives will stem from these essential topics:

- Introduction to statistical terms and statistical thinking including: understanding the definitions of population, sample, parameter, and statistic; distinguishing between inferential and descriptive statistics
- Types of data; collecting sample data
- Frequency distributions; organizing data
- Graphs that enlighten and graphs that deceive; bar graphs vs. histograms; qualitative graphs vs. quantitative graphs
- Measures of center to include: mean, median, and mode
- Measures of variation; measures of relative standing and boxplots to include: relevance of variance and standard deviation, interquartile range, outliers, range, boxplots with fences, percentiles, and z-scores
- Basic concepts of probability to include: sample space, theoretical vs. empirical probability, disjoint vs. independent events, and the fundamental counting principle
- Probability rules, to include: addition, multiplication and conditional
- Discrete probability distributions to include: random variables and expected value
- Defining normal distribution and relating probability to area under the curve with applications, to include: normal distributions with any mean and standard deviation and the Empirical Rule
- Investigating the significance of the Central Limit Theorem as it applies to sample means and proportions; calculating the confidence interval for population proportion and population mean, σ known
- Basics of hypothesis testing, to include: assumptions for testing, applying steps in hypothesis testing with emphasis on interpreting results, differentiating between Type I and Type II errors, defining and applying a level of significance (to include p-value and critical regions), and the relevance of sample size
- Testing a claim for population proportion
- Testing a claim for a population mean, σ known
- Correlation and regression, including: scatterplots, interpreting r, correlation does not equate to causation, interpreting the slope of a regression line, making predication using a regression line, and extrapolation

Optional Topics

- Frequency polygons
- Stem and leaf plots
- Circle graphs (pie charts)
- Dot plots
- Time – series graphs
- Midrange
- Binomial distributions
- Sampling distributions
- Uniform distributions
- t-distribution
- Chi-Square distributions
- Combinations
- Permutations
- Estimating population standard deviation
- Determining the equation of a line of regression
- Hypothesis testing for the mean when the standard deviation is unknown
- Making inferences for correlations
- Calculating residuals
- Other

****NOTE:** At least 70% of the course time must be spent on the essential topics. All essential topics must be addressed. The course must be at least a 3-credit hour course. If the course is more than 3 hours credit, then the essential topics comprise 70% of the three-hour portion of the class. The remaining 1-2 credit hours may be used for optional topics as part of the co-requisite portion of the course.

Template for Course Inventory

Please fill out the following table and submit attachment(s). Approved courses must be resubmitted every 5 years.

Please attach the following materials:

- Current working syllabus and lab syllabus that contains instructional goals and/or objectives
- Comprehensive final; in the absence of a comprehensive final no more than 5 sample assessments

Course #			
Course Title			
Beginning Term (when is/was it first offered?)	If more than five years, check box ☐		
	If less than five years, enter date:		
Credit Hours (including the entire course, lecture/lab)	Course:		
Co-/Pre-requisite (test scores for placement)		Test	Score
	Co-Requisite		
	Pre-Requisite		
Successor Course:			
Catalog Description			
All Textbook(s)/Lab Manual	ISBN: Title: Publisher: Author: Edition: Copyright Year:	ISBN: Title: Publisher: Author: Edition: Copyright Year:	

Indicate the percent time spent on each learning objective (should add up to 100%). To indicate where evidence of each learning objective is located in this submission, please check all boxes that apply.

S – Syllabus T – Topics list C – Catalog Description A – Assessment O – other attachment

Indicate the typical percentage of time spent on each learning outcome/topic	**Learning Outcome/topic**	**% Time**	**S**	**T**	**C**	**A**	**O**
	1. Introduction to statistical terms and statistical thinking including: understanding the definitions of population, sample, parameter, and statistic; distinguishing between inferential and descriptive statistics						
	2. Types of data; collecting sample data						
	3. Frequency distributions; organizing data						
	4. Graphs that enlighten and graphs that deceive; bar graphs vs. histograms; qualitative graphs vs. quantitative graphs						
	5. Measures of center to include: mean, median, and mode						
	6. Measures of variation; measures of relative standing and boxplots to include: relevance of variance and standard deviation, interquartile range, outliers, range, boxplots with fences, percentiles, and z-scores						
	7. Basic concepts of probability to include: sample space, theoretical vs. empirical probability, disjoint vs. independent events, and the fundamental counting principle						
	8. Probability rules, to include: addition, multiplication and conditional						
	9. Discrete probability distributions to include: random variables and expected value						
	10. Defining normal distribution and relating probability to area under the curve with applications, to include: normal distributions with any mean and standard deviation and the Empirical Rule						
	11. Investigating the significance of the Central Limit Theorem as it applies to sample means and proportions; calculating the confidence interval for population proportion and population mean, σ known						
	12. Basics of hypothesis testing, to include: assumptions for testing, applying steps in hypothesis testing with emphasis on interpreting results, differentiating between Type I and Type II errors, defining and applying a level of significance (to include p-value and critical regions), and the relevance of sample size						
	13. Testing a claim for population proportion						
	14. Testing a claim for a population mean, σ known						

	15. Correlation and regression, including: scatterplots, interpreting r, correlation does not equate to causation, interpreting the slope of a regression line, making predication using a regression line, and extrapolation							
Non-essential topics (may not be covered at all)	16. Frequency polygons							
	17. Stem and leaf plots							
	18. Circle graphs (pie charts)							
	19. Dot plots							
	20. Time – series graphs							
	21. Midrange							
	22. Binomial distributions							
	23. Sampling distributions							
	24. Uniform distributions							
	25. t-distributions							
	26. Chi-Square distributions							
	27. Combinations							
	28. Permutations							
	29. Estimating population standard deviation							
	30. Determining the equation of a line of regression							
	31. Hypothesis testing for the mean when the standard deviation is unknown							
	32. Making inferences for correlations							
	33. Calculating residuals							
	34. Other:							
Additional Comments:								

Name of individual submitting:_____Date:_____

Email address:_____

Please contact WVHEPC, Academic Affairs with questions