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Course Syllabus

STAT 240: Statistical Analysis

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Description: *An introduction to probability and statistics for students who have completed a semester of calculus. Topics include probability, empirical and theoretical frequency distributions, sampling, correlation and regression, testing hypotheses, and estimation of parameters, with an emphasis on illustrations and applications of these techniques.*

Credit Hours: 3

Frequency: Offered every semester

Audience: Not open to students with credit for STAT 140, IDS 205, CE 202, or PSY 201.

Prerequisites: MATH 131 (Calculus I)

Format: 3 class sessions (50 minutes each) per week

Textbook: *Introduction to the Practice of Statistics, 8th Ed.*, by Moore, McCabe, and Craig. ISBN-13: 978-1464158933 (*recommended, not required*)

Technology: Use of Microsoft Excel is required for the homework and group project. Microsoft Excel can be found on all campus computers and can also be downloaded freely from the University at this link: `http://www.valpo.edu/it/2015/02/13/office-365-now-available-free-of-charge/`. A calculator that is not on a cell phone/tablet/laptop is required for the exams, and should also be brought to class daily for in-class activities. Course materials and grades are maintained in Blackboard, and students should check Blackboard regularly.

Disability Support: Students with a documented disability who need classroom accommodations, such as extra time for test-taking, note-taking assistance, readers, etc., are recommended to contact Disability Support Services at 219-464-6496.

Notice of Cancellation: In the unlikely event class is cancelled, you will be notified through your Valparaiso University e-mail account.

Student Learning Objectives:

A. Students can describe data through appropriate numerical summaries and graphical displays and perform statistical inference, using statistical software when applicable.

B. Students understand the probability concepts, including the central limit theorem, which lay the mathematical foundation for statistical inference.

C. Students can identify, design, and carry out data collection procedures, recognizing and controlling for the effects of bias and variability.

D. Students can effectively communicate the results of statistical analyses in both oral and written form through the use of both technical and nontechnical language.

Topics Encountered:

1. describe data using graphical displays, such as bar graphs, pie charts, stemplots, boxplots, histograms, and scatterplots

2. describe data using numerical quantities, such as five number summaries, mean, variance, and standard deviation, and identify the effect of outliers

3. identify the properties of the normal distribution and perform probability and inverse calculations, aided by a standard normal table

4. use correlation to measure the relationship between two quantitative variables, but recognize its limitations and the difference between correlation and causation

5. fit and interpret a least squares regression line, comment on the strength of fit using R-squared, and comment on the quality of fit using a residual plot

6. read a two-way table and find marginal, conditional, and joint distributions from the table, in order to describe the relationship between two categorical variables

7. identify the difference between an experiment and an observational study and carry out any of the various randomization/sampling schemes using a random number table

8. know what a sampling distribution is (and is not) and understand how to control bias and variability

9. apply basic probability rules (complement, union, intersection, conditional, and Bayes) and identify independent and disjoint events

10. describe both graphically and numerically the probability distribution of a random variable and classify a random variable as either discrete or continuous

11. find the mean and variance of either a discrete or continuous random variable, along with linear combinations of random variables

12. know the key idea of the central limit theorem, apply it, and recognize its importance in statistical inference

13. recognize the binomial setting and use the binomial formula and normal approximation for probability calculations

14. understand the idea of statistical confidence, know the general form of a confidence interval, and interpret a confidence interval in the context of the problem

15. identify the difference between a null and alternative hypothesis, as well as a one-sided and two-sided test

16. make a conclusion based on a p-value, know what it means to be statistically significant, and interpret a conclusion in the context of the problem

17. recognize which confidence interval/hypothesis test to conduct and be able to carry out each of the following:

    (a) One-sample z-test/interval for a single population mean
    (b) One-sample t-test/interval for a single population mean
    (c) Paired t-test/interval for a single population mean difference
    (d) Two-sample t-test/interval for the difference between two population means (unpooled and pooled)
    (e) One-sample z-test/interval for a single population proportion
    (f) Two-sample z-test/interval for the difference between two population proportions