**AP Statistics Syllabus**

*Course Design*

One of the greatest differences between teaching statistics and teaching other mathematics courses is the ease with which a teacher may vary instruction and activities. In the AP statistics classes, students will be asked to work in groups that vary in size to foster discussion on a variety of statistics topics such as methodology and inferences. In addition, students will be asked to work in groups to collect and analyze real life data in many different situations throughout the year. [C4, see notes below for descriptions]

Teaching materials for the course come from textbooks, classroom lectures, other print media, videos, and the Internet. At the beginning of the year, students will receive a list of formulas and tables that are necessary. Students are also required to obtain a TI -83 or TI-84 calculator for this class. For those who are unable to obtain one on their own, they may be able to use a classroom set that are occasionally available or are able to borrow one on an as-need basis from the math department. Microsoft Excel and/or Google Sheets will be other programs used to display and analyze data. There is also currently a request to purchase MINITAB software for students to use in the Math Computer Lab. If able to be purchased, students will also be required to use this for assignments and projects. It will also be used for in class demonstrations. [C5]

*Projects*

Projects will be a major part of this course. Students will complete 4 projects during the year that deal on integrating current and previous course content while expanding on their existing knowledge. Projects will be completed inside and outside of the classroom and will include the use of a graphing calculator for data collection as well as Microsoft Excel or Google Sheets for data analysis. If possible, the use of MINITAB will be included as well. These projects require students to design surveys and experiments, gather data, analyze data numerically and graphically, and apply inferential statistics to draw conclusions for a population. Student will write formal reports on their projects using statistical language. [C3, C4]

*Remarks*

The single thing that stands out about teaching statistics is how the unexpected always happens. In talking with colleagues who have taught AP Statistics, I have found that the best advice is to be flexible in the way I approach teaching. More precisely, to try new technologies, allow students more interaction time with each other to work and discover new ideas, and to accept that I will not have all the answers and will learn on the way as well. I find the networking with colleagues and sharing ideas and resources have been an integral part in my planning and development as a professional.

*Primary Textbook and References*

(noted with the following letters in the outline)

T Moore, Starnes, Tabor, and Yates. *The Practice of Statistics*. 5th ed. New York: W.H. Freeman, 2014.

W Moore, David S. *Statistics: Decisions Through Data*. 1st ed. Massachusetts: COMAP, 1992.

TI Texas Instruments TI-83/84 graphing calculator.

EX Microsoft Excel.

O Other resources used in the classroom come from articles in newspapers, journals, and the World Wide Web. Students will bring in data sets they collect or download from the Web.

*Course Outline and Content*

**Fall Semester**

|  |  |  |
| --- | --- | --- |
| **Week** | **Content** | **Text and Resource Materials** |
| **Week 1** | Introduction to Statistics.Students read about ethics in research testing and experiments, and the role of statistics in medicine and society. Essay: “What is Ethics in Research and Why is it Important” from the National Institute of Environmental Health[C3] | O Reading from World Wide  Web.O Video: *What is Statistics?* O Activity: M&M’s activity  |
| **Weeks 2-3**HWChapter 1 Introduction1, 4, 6, 7, 8 Chapter 1.1 10, 13, 16, 18, 19, 23, 26, 27-36Chapter 1.237, 39, 44, 50, 51, 58, 59, 60, 64, 68-78Chapter 1.380, 82, 83, 86, 90, 92, 95, 97, 99, 106-113Chapter 1 Review1-9 odd | Exploring Data[C2a]Graphical displays of distributions of univariate data: box plots, stem plots, dot plots, histograms, frequency charts, cumulative frequency charts, time plots and bar charts. Stress center, spread, and shape, and outliers.Summarizing distributions of univariate data. Mean, median, mode, range, interquartile range, quartiles, standard deviation.Comparing distributions of univariate data. Compare center, spread, clusters, gaps, outliers, and shapes within groups and between dot plots, stem plots, and box plots.Standard deviation and variance. Properties of standard deviation and the effects of changing measurements and linear transformations on summary measures. [C2a]Approximately 4 days are spent with instruction with TI calculators and Microsoft Excel.Students use class generated data in the class for classroom exercises.Activity: Class data collecting activity of licks to the center of a tootsie pop. Write ups due at the end of the 3rd week.Test | T pages 2-81O Student presentations for section 1.1 and 1.2O Practice AP test problemsT Formula SheetEX/TI Tootsie Pop LabT FRAPPY on p. 74 |
| **Weeks 4-5**HWChapter 2.11, 3, 5, 10, 12, 15, 16, 17, 20, 22, 25-32Chapter 2.234, 35, 37, 40, 41, 43, 46, 48, 49, 52, 53, 55, 57, 66, 69-76Chapter 2 Review1-11 all | Density curves and the Normal Distribution. Measuring position, quartiles, percentiles, standardized scores (z scores). Using the normal distribution as a model for measurement. Normal probability plots.Students spend two days in the computer lab standardizing data, graphing normal probability plots, and interpreting information from the graphical and numerical displays of data. [C5]Video: *Describing Data*Test | T pages 82-137O Video: *Describing Data*O Practice AP test problemsT Table A (z-distribution)O Calculator Command SheetT FRAPPY on p. 134 |
| **Week 6**HWChapter 3.12, 4, 5, 7, 11, 13, 15, 17, 20, 21, 26-34 | Scatter Plots and Correlation[C2a]Explanatory and response variables, analyzing patterns in scatter plots, correlation and linearity. | T pages 140-163TI Used for scatterplots and residual plots |
| **Week 7-8**HWChapter 3.237, 40, 42, 46, 47, 51, 54, 56, 60, 62, 64, 65, 68,71-81Chapter 3 Review1-6 all | Bivariate Data[C2a]Least squares regression line, residual plots, outliers, influential points, and transformation to achieve linearity.Approximately two days are spent in instruction with TI graphing calculator.Two days are spent in the classroom for a data collection and line fitting lab. Students will work together to generate 3 sets of bivariate data. Students use calculators/computers to write equations of lines that best model their data. [C5]Videos: *Decisions through Data- Correlation and Describing Relationships*Project: Describing Relationships Lab. A data collection and analysis project is due at the end of the 8th week.Activity: Exploring the effects of outliers and influential points.Test  | T pages 164-205O Worksheet on curve fitting W Worksheets and Videos: *Decisions through Data- Correlation and Describing Relationships*TI/EX Used for activity and projectT FRAPPY on p. 199 |
| **Weeks 9-11**HWChapter 4.12, 5, 8, 10, 11, 13, 17, 21, 24, 25, 28, 29, 32, 36-44 allChapter 4.248, 49, 52, 57, 60, 61, 64, 66, 67, 70, 71, 73,75, 80, 82, 85, 87-95 allChapter 4.397, 98, 101, 102, 113, 114Chapter 4 Review1-10 all | Experimental Design, Sampling, and Randomness. [C2b]Videos: *Decisions through Data- Experimental Design and Sampling.*Activity: See no evil, hear no evil?Different methods of data collection, simple random sampling, sampling error, bias, stratifying, confounding, blocking, and replication.How to experiment well, experimental design, experimentation for inference.Using Studies Wisely.Video: *Decisions through Data- Causation*A project on writing a questionnaire and conducting a survey is due at the end of the 13th week.Test. | T pages 206-285W Worksheets and videos: *Decisions through Data- Experimental Design and Sampling.*W Worksheet and video: *Decisions through Data- Causation*O Practice AP test problemsO Article: *Thedacare’s Survey Results Can Be Explained*.T FRAPPY on p. 275T Table D – Random DigitsO Practice AP Test #1 |
| **Weeks 12-14**HWChapter 5.12, 4, 6, 8, 12, 16, 20, 23, 30, 31-38 allChapter 5.2 40-62 evenChapter 5.3 63, 66, 68, 69, 71, 74, 76, 77, 79, 82, 84, 88, 90, 91, 94, 97-102 allChapter 5 Review1-10 all | Probability[C2c] Basic Probability Rules, independence, sample spaces.Simulations as means to answer probability questions and the law of large numbers.Video: *Introduction to Probability.*Activity: Two days are spent on class activities to develop ideas of probabilities and estimates of proportions.Activity: Let’s Make a DealTwo days are spent on fundamental counting principle, combinations, and permutations.Test. | T pages 286-341O Practice AP test problemsW Probability AppletO Video: *Introduction to Probability*O Chromebook for Probability Applet on p. 290O Let’s Make a Deal WSO Counting Techniques WST FRAPPY on p. 338 |
| **Week 15-17**HWChapter 6.16, 7, 8, 9, 12, 16, 19, 22, 24, 27-34 allChapter 6.236, 38, 42, 44, 46, 50, 52, 54, 56, 60, 62, 67, 68 | Random variables. [C2c]Expected values and standard deviation of a random variable. Mean and standard deviation for sums and differences of independent random variables.One day is spent in class using the TI graphing calculator to develop rules for the mean and variance of independent random variables and probability distributions. [C5]Video: *Probability Distributions.*Activity: A lottery is run every day for one week using the Wisconsin lottery model with prizes awarded. | T pages 344-417O Practice AP test problemsTI Used for activity |
| Chapter 6.371, 74, 76, 78, 81, 86, 88, 95, 97, 101, 102, 103, 104, 106, 107Chapter 6 Review1-7 all**Week 18**HWChapter 7.12, 4, 6, 8, 10, 14, 16, 18, 20, 22, 24, 26Chapter 7.228, 29, 34, 35, 37, 39, 43-48 all | Simulating Distributions. [C2c]Binomial probabilities, binomial distribution, normal approximation for counts, geometric distributions and probabilities associated with geometric distributions.Video: *Decisions through Data- Binomial Distributions.*Sampling distribution of a sample mean and sample proportion, central limit theorem.Normal approximation for sample proportionsSemester 1 Final Exam. | TI Used for activityO 12 Days of Statistics WorksheetW Worksheet and video: *Decisions through Data- Binomial Distributions.*FRAPPY on p. 414T pages 420-449W Candy Machine Applet O Practice AP test problemsW Sampling Distribution Applet |

**Spring Semester**

|  |  |  |
| --- | --- | --- |
| **Week** | **Content** | **Text and Resource Materials** |
| **Weeks 1**Chapter 7.349-63 odd, 65-72 allChapter 7 Review1-7 | Activity: In class activity using, central limit theorem applet on the web, TI calculator, and excel (MINITAB if available) on sampling distribution and the central limit theorem. Write up due at the end of the third week. [C5]Test. | T pages 450-467O Practice AP test problemsTI Used for projectEX Used for projectT FRAPPY on p. 464O Practice AP Test #2 |
| **Weeks 2-3**HWChapter 8.11-19 odd, 21-26 allChapter 8.228, 30, 32, 34, 36, 40, 42, 44, 46, 48, 49-54 allChapter 8.356, 57, 60, 61, 65, 68, 69, 72, 75-80 allChapter 8 Review1-10 all | Confidence Intervals. [C2d]Estimating population means and proportions, critical values, margin of error, and sample size.Approximately one day is spent on TI to show how to perform confidence intervalsVideos: *Decisions through Data- Confidence Intervals and Significance Tests*Activity- *Mystery Mean* on p. 476Test. | T pages 474-533W Worksheets and videos: *Decisions through Data- Confidence Intervals*TI Used to calculate confidence intervalsW Confidence Interval AppletO Practice AP test problemsT Table B – t –distributionT FRAPPY on p. 530 |
| **Weeks 4-6**HWChapter 9.11, 3, 7, 9, 11, 13, 17, 19, 21, 23, 25-31 allChapter 9.232, 33, 36, 37, 40, 41, 46, 48, 50, 51, 54, 55, 57, 59-64 allChapter 9.365, 69, 73, 77, 79, 83, 85, 87, 89, 93, 95-104Chapter 9 Review1-7 all | Hypothesis Testing. [C2d]Activity – *I’m a Great Free Throw Shooter!* on p. 538Null and alternative hypotheses, p values, statistical significance, z test for population proportion, t test for population mean, and two-sided tests.Type I, Type II errors, and powerStatistical significance, practical significance, and data snooping. Large-sample inference for a population proportion, confidence interval for a population proportion, sample size, and margin of error.Students will spend one day on using TI calculators to perform significance tests.Video: *Decisions through Data-Inference for Proportions*Test. | T pages 536-605W Free throw shooting appletO Worksheet on Type I and Type II errorsO Practice AP test problemsTI Used for calculations of significance testsW Worksheet and video: *Decisions through Data-Inference for Proportions*T FRAPPY on p. 601 |
| **Weeks 7-8** HWChapter 10.14, 5, 8, 9, 12, 14, 16, 18, 21, 23, 25-30 allChapter 10.231, 33, 36, 37, 40, 42, 44, 48, 51, 53, 57-64 allChapter 10 Review1-7 | Activity: Is Yawning Contagious? C3, C4]The distribution, standard error, one-sample *t* procedures, matched pairs *t* procedures.Confidence intervals for the difference between two proportions, significance tests for comparing two proportions, pooled estimate of p.Comparison of two means, two-sample t statistic, two-sample independent *t* procedure.Activity: *Does Polyester Decay?* on p. 634Video: *Decisions through Data- Comparing Two Means.*Project: Analysis of a research article from a peer reviewed research journal is due at the end of the 12th week.Test. | T pages 609-665O Mythbusters: *Is Yawning Contagious?*W Worksheet and Video: *Decisions through Data- Comparing Two Means.*O Practice AP test problemsT FRAPPY on p. 662 |
| **Weeks 9-10**HWChapter 11.12, 4, 6, 7, 10, 11, 15, 18-26 allChapter 11.227, 29, 31, 34, 36, 37, 39, 41, 43, 46, 48, 51-58 allChapter 11 Review1-5 all | Contingency and two-way tables.[C2d]Organizing relations in two-way tables, chi-square test for goodness of fit, homogeneity of proportions, and independence (one and two-way tables). Activity: M&M’s are used to test chi square goodness of fit.Video: *Decisions through Data-Inference for Two-Way Tables.*Test. | T pages 676-733W Worksheet and video: *Decisions through Data-Inference for Two-Way Tables.*O Practice AP test problemsT FRAPPY on p. 730 |
| **Week 11**HWChapter 12.11-13 odd, 17, 19-30 allChapter 12.2FRAPPY! on p. 793 | Inference for Regression. [C2d]Simple linear regression model, estimating regression parameters, confidence intervals and inference for the slope, prediction, point estimators, and confidence interval for a future observation.Transforming exponential data to achieve linearity. | T pages 736-765O Practice AP test problems |
| **Week 12-15**HWAP test packet | Review and prepare for the AP Exam. | O Review packet for the AP ExamO Multiple AP practice examsO Study Guides |
| **Weeks 16-18** | Students spend time in class and in the computer lab working together on their end-of-the semester project.Project report and presentation as final exam grade. | O Final Project guidelines and rubric |

*Notes:*

C2a: The course provides instruction in each of the four broad conceptual themes outlined in the Course Description with appropriate emphasis on exploring data.

C2b: The course provides instruction in each of the four broad conceptual themes outlined in the Course Description with appropriate emphasis on sampling and experimentation.

C2c: The course provides instruction in each of the four broad conceptual themes outlined in the Course Description with appropriate emphasis on anticipating patterns.

C2d: The course provides instruction in each of the four broad conceptual themes outlined in the Course Description with appropriate emphasis on statistical inferences.

C3: The course draws connections between all aspects of the statistical process, including design, analysis, and conclusions.

C4: The course teaches students how to communicate methods, results, and interpretations using the vocabulary of statistics.

C5: The course teaches students how to use graphing calculators and demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring and analyzing data, assessing models, and performing simulations.

The following topics are not specifically mentioned in the course outline. However,

these are integrated into the course as needed:

* Census
* Cluster sampling
* Control
* Experimental group
* Placebo effect and blinding
* Generalizability of results
* Observational study
* Treatments
* Experimental units