

**Center for Talent Development
Northwestern University
Syllabus AP Statistics
Gifted Learning Links Program**

Course Title:
AP Statistics

Course Description:

(Prerequisite: Algebra I) This course is an introductory, non-calculus based college statistics course that emphasizes understanding and analyzing statistical studies. Participants develop skills in sampling procedures, analyzing data, designing and analyzing surveys and experiments, as well as hypothesis testing. The course emphasizes the development of an intuitive understanding of statistics and probability. Students gain a sense of the importance/relevance of statistics in the real world and are able to evaluate the use and misuse of statistics. This course will prepare students for the AP Statistics exam.

The major topics to be covered are:

1. **Data collection:** sampling, experimentation
2. **Measurement:** level, validity, confidence, abuses, interpretation
3. **Presentation of data:** tables, graphs, distortions
4. **Describing data:** distributions, measures of central tendency, dispersion, indexes, association, percentiles, etc.
5. **Probability:** counting, simulation, expected value, and law of large numbers
6. **Drawing conclusions from data:** tests of significance, errors, hypothesis testing, inference, and common sense.

Outcomes: Upon successful completion of this course, students will:

- a. be able to think statistically and apply this skill to analysis and problem solving in the real world.
- b. appreciate the difficulty of gathering worthwhile information using survey or experimental tools.
- c. know how to use basic statistical analysis technology via computer and calculator.
- d. have an understanding of the abuse and misuse of statistics.
- e. be able to take data and re-express it to gain more information.
- f. be a more intelligent consumer of information.
- g. be prepared to take the AP Statistics exam

Resources and Materials:

Text: Intro Stats by De Veaux, Velleman, and Bock 3rd edition. ISBN-13: 978-0-321-50045-8 .The book includes Activstats, a CD-ROM that parallels the text.

Optional: Student's Solution's Manual ISBN-13:978 0-321-49941-7

Technology: Since this is an on-line course, access to and comfort with computers is assumed. Students may use graphing calculators to work on the problems. It is recommended that they do so since

they will be allowed for the AP exam. For this course, problems will be handed in on spreadsheets using Excel where appropriate.

Required Software:

Fully installed Microsoft Excel that includes the Data Analysis Tools.

Course internet tool:

Research Randomizer: <http://www.randomizer.org/>

This link will allow you to generate sets of random numbers more easily for your assignments.

Student Evaluation and Grading Policies for Credit Courses Only:

a. Grading scale

A= 90–100% average

B = 80–89% average

C = 70–79% average

D = 60–69% average

Failure = below 60%

b. Breakdown of final grade:

Submission and completion of general problems
until they are satisfactory: 15%

Vocabulary Quizzes: 15% (5% each)

2 Problem sets that are completed
for a grade: 30% (15% each)

Survey project: 40%

Instructor Biography:

Eunice D. Goldberg, PhD, received her doctorate at Northwestern University (Intellectual Development, Learning, and Instruction) in 1990. Her area of concentration was mathematics education. She received her bachelor's degree in mathematics from the University of Illinois (Champaign-Urbana) in 1964 and her MS degree in Secondary Mathematics Education from DePaul University in 1972.

Dr. Goldberg has been a part of the faculty at the Center for Talent Development since 1984. She originally taught in the summer pre-calculus program. In 1991 she began to teach statistics for the summer program. Dr. Goldberg joined the Letter-Links program for AP Statistics in 2000, changing the course to the on-line format.

Dr. Goldberg coordinates the IASE International Statistical Literacy Project web-pages at <http://www.stat.auckland.ac.nz/~iase/islp/art> and <http://www.stat.auckland.ac.nz/~iase/islp/teachtra> to supply statisticians and teacher educators around the world with resources for teaching their classes and/or improving their knowledge.

Dr Goldberg trains teachers to teach mathematics as an assistant professor at National-Louis University in the College of Education. Her primary assignment is to teach teachers how to teach mathematics while presenting them with new content that represents the subject areas being taught in the middle school. She also does enrichment work with students at Baker demonstration school and selected Chicago schools. In particular she works with a Social Studies class to help students integrate statistics through surveys in their 20th Century Research Project.

Dr. Goldberg's present area of interest is developing and piloting math materials that are flexible enough to include both ends of the learning spectrum. She is particularly concerned about the loss of attention being paid to more advanced students now that classrooms are more inclusive. Her goal is to show

teachers how to develop materials that will keep all students engaged and challenged by allowing them to do more exploring and asking of “what-ifs”. She has presented these ideas with examples at several conferences including ICET (International Council on Education for Teaching) and NCSM (National Council of Supervisors in Mathematics).

Contact Information:

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Teaching Methodology:

A course web-site has been created using Course-Info and Blackboard through Northwestern University. On that web-site you will find assignments, articles, information, and methods for communication with other classmates. Communication will be mainly through e-mail and the web-site. Assignments will be turned in using the DIGITAL DROP BOX. There will be occasional phone calls. An initial phone call will be made to get you started on your project.

All assignments should use word processing. Assignments requiring spreadsheets are already set up in that format in Excel. You will need to insert your data and follow directions to do the appropriate computations, make charts and/or tables. You may also use Activstats in conjunction with Excel. Any charts done in Activstats must be moved into an Excel spreadsheet or else it will not open from the Digital Drop Box.

Group Work:

You are encouraged to contact other students taking the class. You may join in a conversation with other students on the Blackboard Web-site. Some students like to do their MAJOR SURVEY PROJECT in a group. If you decide to do that, just let me know so that I can communicate with the entire group.

Types of Assignments:

1. **TEXTBOOK AND ON-LINE:** Assignments will be made for both your text and the CD-ROM. You will be told the sections that are necessary to study. Because the CD-ROM element of your textbook is interactive you will have many opportunities for feedback as you are doing your work.

WHEN YOU RUN INTO SOMETHING YOU DON'T UNDERSTAND PLEASE E-MAIL ME WITH YOUR QUESTIONS AND I WILL GET BACK TO YOU AS SOON AS POSSIBLE.

On-line assignments will be posted on the web site. You will submit them to the **digital drop box**.

2. **SPECIAL PROBLEMS and ACTIVITIES:**

On the web-site you will find problems to do that will enhance what you are learning in the book and/or inform me of your understanding of a topic. You will find these assignments on the web-site. You will be told which assignments to hand in.

There will also be several vocabulary quizzes.

3. **TWO PROBLEM SETS WILL BE SUBMITTED THAT WILL COUNT AS EXAMS. THEY WILL BE ON THE WEB-SITE. PLEASE DO NOT DO THEM UNTIL YOU HAVE COMPLETED THE REQUIRED WORK.**

4. **SURVEY/EXPERIMENT**

For this assignment you will decide on a topic you would like to learn more about. (THE TOPIC COULD EASILY FIT INTO COURSE WORK YOU ARE DOING FOR ANOTHER CLASS SUCH AS SOCIAL STUDIES OR SCIENCE) Once the topic is approved you will:

- Develop a questionnaire that will help you get your information.
- Collect data from at least 75 subjects. (This number can be reduced if you are working with other students.)
- Input data in an Excel spreadsheet.
- Analyze your data. If you worked with other students, compare your data to theirs for major differences.
- Write a paper that describes this process and includes your analysis.

TO GET STARTED:

1. Install your CD-ROM on your computer. Under preferences you can choose a text for alignment of your CD. Select your text book under preferences: Intro Stats, 3R^d edition. This will put the Activstats chapters in the same order as your text.

2. Familiarize yourself with your CD-Rom so you can use it with ease once you start the formal assignments. Go through introductory materials. **Install DDXL on your computer.** (This is an enhancement to EXCEL that remains on your computer when you remove the disc,)

3. Think of some topics of interest to you for your project. The newspaper is an excellent resource for ideas. Be sure to select something that you are curious about. Otherwise it will be a LONG YEAR if you pick something that you dislike or find boring. GO TO THE BLACKBOARD WEBSITE AND JOIN IN A CONVERSATION TO HELP YOU FIND YOUR TOPIC.

Schedule:

The following includes lists of sections to read and activities to serve as a guide for your studying. The week in the course when the assignment is due is indicated. These dates are approximate and are to be used to help you pace yourself.

In Intro Stats the chapters to read are indicated. Working through the examples is highly recommended. Exercises follow each section. All of the problems are conceptual in nature and provide good practice for the type of thinking that will be most helpful in writing your paper and completing graded problems. Sections of Activstats are indicated. When you read through Activstats you are encouraged to click on all icons in order to do the examples within the text. If you feel a need to practice more problems, you are encouraged to look at the homework problems and projects.

TOPIC, READINGS, AND ASSIGNMENTS WITH DUE DATES

Subm,				
	TOPIC	READINGS	ASSIGNMENT	TURN-IN to Digital Drop Box
WEEK 1	Introduction	Familiarize yourself with the text and the CD-ROM	1. Orientation to on-line learning. 2. Install DDXL on your computer. 3. Fill out Information Sheet	Submit Information Sheet
Weeks 2-8	Unit 1: Sample surveys, randomness and experiments	Intro Stats: Chapters 11,12,13 Activstats: 1,10,11,12	Do all parts of the experiment starting in Activstats p. 11-3	

	Weeks 2-8			
Week 2-3	Sample Surveys	1.Sampling Notes 2.Polling's Dirty Secret: Non response	1.Proportional Representations 2.Stratified Sample 3. Anonymity vs. Confidentiality	Submit all three assignments
Week 4	Writing Survey Questions	1.Tax Poll Loopholes 2. Guidelines for Asking Questions	Learning from bad examples Decide on topic for final project	Hand in Learning from Bad Examples Submit topic for approval
Week 5	Randomness	Some ideas about randomness to think about	1. Fake vs. Real Coin Tosses 2. Simulating Tossing a Die 3. Changing average as more results are added 4. Take vocabulary 1 quiz	Hand in all three assignments Hand in Quiz
Weeks 6-8	Experiments	1.Notes for experiments 2. News articles	1. Design issues for experiments 2. Fitness Experiment 3.Heart Disease 4.Insomnia Experiment 5. Zyrtec Experiment 6. First Draft of Questionnaire 7. Take vocabulary 2 quiz	Submit all seven assignments
Weeks 9-18	Unit 2: Measurement: Data, Counting, Center: Mean, Median, Mode, Displaying Data Bivariate Data and Correlation	Intro Stats: Chapters 1,2,3,4,5,6,7,8,9 Activstats: 2,3,4,5,6,7	1.Make sure you understand Simpson's Paradox. 2.In Activstats do the experiment on page 2-3 3.In chapter 3, draw the graph	
Weeks 9-12	Measurement	1. Key Ideas for Measurement 2. Readings for measurement	1. A Year in the life of a child 2. How much can you fit in a day? 3.Simpson's Paradox Plus 4. Ranking Students 5. Take vocabulary quiz 3.	Submit all four assignments
Weeks 13-16	Displaying Data	1. Notes on graphing 2. Chart for graphs 3. Samples of graphs with errors	1. Data for graphs 2. Compare two schools 3.IQ scores 4. Box plots	Submit all four assignments
Week 15			Final questionnaire	Submit final questionnaire
Weeks 16-17	Measures of Central Tendency			
Week 16	Mean, Median, Mode, Standard Deviation	1. Notes on mean, median, and mode 2. Notes on Standard Deviation	1. Compare two algebra classes 2. Confidence Intervals	Submit the two assignments
Week 17	Understanding	1.Illustrations for the	1. Coin experiment	Submit both

Week 17	Understanding the Central Limit Theorem	1. Illustrations for the Central Limit Theorem 2. Comparing two normal curves	1. Coin experiment 2. Weight data	Submit both assignments
Week 18	Bivariate Data and Correlation	Notes on Correlation	1. Data on Grades in Courses 2. Infant Mortality Related to Mother's Literacy	Submit both assignments
Week 19	Final 1 st semester		Do Problem Set 1	Submit Problem Set 1
Week 20-22	Unit 3 CPI,			
Week 20	Consumer's Price Index	1. Bureau of Labor Statistics 2. Notes describing an index Technical Information	Consumer's Price Index Begin data collection Write introduction to your paper	Submit assignment
Week 21-22	Other Indices		Tooth Fairy Index Medical Index Power Index	Submit the three assignments
Weeks 23-30	Unit 4 Probability and Hypothesis Testing, Formal Statistical Reasoning, Inference	Intro Stats: Chapters 11,12,13,14,15,16,17,18,19, 20 Activstats:14, 15,16,20,21,22,23,24,26		
Week 23-24	Probability	1. Probability notes 2. Probability with Less Pain 3. Benford's Law	1. Real Life Conditional Probability (HIV and Lie Detector) 2. Birthday Problem 3. Expected Value 4. Pigeon Hole Theory	Submit the four assignments
Week 25-30	Inference What is p-value?	T-table Chi-Square Notes	1. Type 1 and Type 2 Errors 2. Inference 3. Difference of two means 4. Chi-Square Problems	Submit the four assignments
Week 28			Data collection complete With instructor's guidance enter data in a spreadsheet	Submit spread sheet and a list of questions you hope to be able to answer with your data.
Week 30	Final		Complete problem set 2.	This is your final for the course. Submit Problem set 2
Week 30-36	Final analysis of data from survey	Read description of project so you can write	Finish paper	Submit Paper

MORE DETAILED INFORMATION ON ASSIGNMENTS FOLLOWS:

Two Sets of problems will be posted TWICE during the course. They will be in lieu of exams. They will count as 30% of your grade. (15% EACH)

Problem CORRECTIONS:

In addition to assessing your knowledge, your problem set is considered to be a learning experience. Therefore you will be allowed to make corrections. To get credit for your corrections they must be:

1. Clearly labeled and done correctly on a separate piece of paper.
2. Accompanied by a clear explanation of what you did wrong and what you now understand.
3. Accompanied by a clear explanation of how you found the correct answer (page number, article, notes, etc.)
4. Stapled to your original problems when handed in.

ONLY CORRECTIONS DONE IN THIS FORMAT WILL RECEIVE CREDIT. There are no exceptions. Any allowances are at the discretion of the instructor Different problems will be worth varying amounts of points. **These problems are being given to you instead of an exam.**

GLL SAMPLE

PROJECT OVERVIEW:

(The directions are written for a survey. However if you want to work with a science teacher to design and conduct an experiment you may use the data analysis from that for your project, as long as you will have sufficient data to demonstrate your knowledge.)

You will design a survey, collect and analyze data, and write a paper based on the findings. You will develop a survey question and questionnaire, collect data, and write a paper. You will gain an appreciation of the difficulties involved in conducting a meaningful survey and making sense out of "messy" data by **DOING STATISTICS.**

THE FOLLOWING ARE THE STEPS YOU SHOULD COMPLETE FOR THE PROJECT. **I NEED TO BE INFORMED OF THE TOPICS YOU ARE CONSIDERING. WE WILL DISCUSS YOUR IDEAS THROUGH E-MAIL.** IF YOU ARE WORKING IN A GROUP YOU SHOULD BRAINSTORM AND SHARE YOUR IDEAS WITH ME.

1. Select a question you want to have answered.

- a. State your overall question
- b. State what you hope to find from your study
- c. State what you think the survey will show.

YOUR QUESTION CAN INVOLVE CURRENT EVENTS OR an ISSUE or it can be TIED TO A PROJECT IN ANOTHER COURSE.

2. Decide the information you need in order to answer your question and write a questionnaire: (Hint: More is not better!)

Some questions must have numerical answers. (One way this can be accomplished is by writing some questions with scales from 1-10) Include any demographic information such as age, sex, ethnic background, education, etc. as appropriate.

DO NOT BEGIN TO COLLECT DATA UNTIL YOU HAVE FINAL APPROVAL OF YOUR QUESTIONNAIRE FROM ME.

3. Pilot questions on classmates and rewrite questions if necessary.

4. Decide how to conduct the survey (phone, paper-pencil, etc.) Remember you want to do it in a way that will give you the most responses.

5. Decide who will be in your survey (the sample)

- a. population you are trying to address?
- b. sample frame
- c. describe sample (SRS, stratified, convenience, size, etc.)

HAVE REASONS FOR ALL OF YOUR CHOICES

6. Collect your data.

7. If you are in a group pool the data and discuss the interpretations.

- a. all data put on a spreadsheet in Excel using the class website **I WILL GUIDE YOU WITH THE DESIGN OF YOUR SPREAD SHEET.**
- b. if you work in a group, separate your data from the group's on a separate workbook page
- c. make back-up copies of all data on separate disks

8. Write a final report in which you:

- a. Analyze the data
 - (1) If you worked in groups compare your data to the group data and discuss commonalities and differences.
 - (2) Use appropriate statistics and charts.
- b. Note problems you encountered and how you might improve if you were to conduct your survey again

INTRODUCTION (to be completed before data analysis begins):

1. Why did you conduct the survey? What did you think you would find?
2. What questions did you ask to get the information you needed? What demographics did you ask for? Give reasons for your questions.
3. How did you conduct your survey? (interview, paper and pencil questionnaire; you filled out questionnaire, phone calls, mail, etc.) Explain why you used this method.
4. Name the population you addressed. Name the sampling frame. Any problems?
5. How did you select your sample? Why? Was there a better way? Does your sample limit what you can say about your results? Explain.
6. Size of sample. Size of group sample. (Explain why)
7. What problems did you encounter when conducting the survey?
8. A plan for your data analysis: a list of questions you hope to answer with your data.

THIS PART OF YOUR PAPER IS TO BE WRITTEN BEFORE YOU BEGIN YOUR DATA ANALYSIS.

ANALYSIS OF DATA MUST INCLUDE:

IF YOU WORKED IN A GROUP:

9. The major findings for the entire group.

10. A discussion of how your data compared with the group's data.

Did your data show the same trends? Where did it differ? Explain.

Use appropriate statistics to do your comparisons such as: percents, measures of center such as mean, median, mode, standard deviation, measures of comparison such as correlations and r^2 .

IF YOU DID NOT WORK IN A GROUP THEN GIVE YOUR MAJOR FINDINGS USING: percents, measures of center such as mean, median, mode, standard deviation, measures of comparison such as correlations and r^2 .

11. Other findings according to your personal interests-- See if answers differ when the data is cut in different ways: Examples: males compared to females; etc. Use **cross-tabulations (pivot tables)**.

12. Appropriate use of statistics. (Be careful when using percents instead of frequencies, especially when the numbers are small) **Insert charts and tables in your paper where they help make the explanation clearer. You must use mean, median, mode, standard deviation and correlations where appropriate.**

Use r^2 where appropriate. What does r^2 tell you?

13. **Do hypothesis testing where appropriate.** What are you looking for? Does it tell you anything valuable?

14. **Discuss what you can't tell from your results.** What would you do to improve your study if you were to do it again?

GLL SAMPLE