SINCLAIR COMMUNITY COLLEGE
DAYTON, OHIO

DEPARTMENT SYLLABUS FOR COURSE IN

MAT 1450 – INTRODUCTORY STATISTICS
(4 SEMESTER HOURS)

1. COURSE DESCRIPTION: An introduction to the fundamental ideas of statistics including statistical methods to gather, analyze and present data; fundamentals of probability; statistical distributions, sampling distributions, confidence intervals, hypothesis testing, Chi-square tests, regression and correlation.

2. COURSE OBJECTIVES: This is a course of study that introduces statistical thinking and methods to students. Based on recommendations from the American Statistical Association, emphasis will be placed on statistical literacy and statistical thinking. The objectives are to give students a conceptual understanding of statistics rather than a mere knowledge of procedures. Technology and real data along with active learning in the classroom will be used to accomplish this goal.

3. PREREQUISITE: Satisfactory score on Mathematics Placement Test or grade of "C" or better in MAT 1365 or MAT 1370.

4. ASSESSMENT In addition to required exams and lab activities on the syllabus, instructors are encouraged to include other components in computing final course grades such as homework, quizzes, and/or special projects. However, 70% of the student's course grade must be based on in-class proctored exams.

5. CALCULATOR: A scientific (non-graphing) calculator is required.

6. TEXT: **THE BASIC PRACTICE OF STATISTICS**, Seventh Edition
Moore/Notz/Fligner
Macmillan Education W. H. Freeman and Company
Adopted: Fall 2015

7. PREPARED BY: Robert Chaney, James Hardman, Najat Baji, David Stott
Ed Gallo, Wendy Cheng

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CLASS SCHEDULE FOR COURSE IN
MAT 1450 – Introductory Statistics
(4 SEMESTER HOURS)

CLASSES MEETING THREE TIMES A WEEK

Lecture	Sections	Topics
1		Introduction to the Class
	1.1	Individuals and Variables
	1.2	Categorical Variables: pie charts and bar graphs
2	1.3	Quantitative variables: histograms
	1.4	Interpreting histograms
	1.5	Quantitative variables: stem plots
	1.6	Time plots
3	2.1	Measuring center: the mean
	2.2	Measuring center: the median
	2.3	Comparing the mean and the median
4	2.4	Measuring spread: the quartiles
	2.5	The five-number summary and boxplots
	2.6	Spotting suspected outliers
5	2.7	Measuring spread: the standard deviation
	2.8	Choosing measures of center and spread
6	2.9	Using technology
	2.10	Organizing a statistical problem
7	3.1	Density curves
	3.2	Describing density curves
	3.3	Normal distributions
	3.4	The 68-95-99.7 rule
8	3.5	The standard Normal distribution
	3.6	Finding Normal proportions
9	3.7	Using the standard Normal table
	3.8	Finding a value given a proportion

MAT 1450 – INTRODUCTORY STATISTICS
THREE TIMES A WEEK SECTIONS CLASS SCHEDULE (*continued*)

Lecture	Sections	Topics
10	4.1	Explanatory and response variables
	4.2	Displaying relationships: scatterplots
	4.3	Interpreting scatterplots
	4.4	Adding categorical variables to scatterplots
11	4.5	Measuring linear association: correlation
	4.6	Facts about correlation
12		*Review*
13		**Test 1 (Chapters 1, 2, 3, 4)**
	5.1	Regression lines
14	5.2	The least-squares regression line
	5.3	Using technology
	5.4	Facts about least-squares regression
15	5.5	Residuals
	5.6	Influential observations
	5.7	Cautions about correlation and regression
	5.8	Association does not imply causation
16	6.1	Marginal distributions
	6.2	Conditional distributions
	8.1	Population versus sample
	8.2	How to sample badly
17	8.3	Simple random samples
	8.4	Inference about the population
	8.5	Other sampling designs
	8.6	Cautions about sample surveys
	8.7	The impact of technology
18	12.1	The idea of probability
	12.2	Probability models
	12.3	Probability Rules

MAT 1450 – INTRODUCTORY STATISTICS
THREE TIMES A WEEK SECTIONS CLASS SCHEDULE (*continued*)

Lecture	Sections	Topics
19	12.5	Discrete probability models
	12.6	Continuous probability models
	12.7	Random variables
	12.8	Personal probability
20	13.1	Independence and the multiplication rule
	13.2	The general addition rule
21	13.3	Conditional probability
	13.4 13.5	The multiplication rule and Independence
22	15.1	Parameters and statistics
	15.2	Statistical estimation and the law of large numbers
	15.3	Sampling distributions
	15.4	The sampling distribution of $\bar{x}$
23	15.5	The central limit theorem
24		Review
25		**Test 2 (5,6,8,12,13,15)**
26	16.1	The reasoning of statistical estimation
	16.2	Margin of error and confidence level
27	16.3	Confidence intervals for a population mean
	16.4	How confidence intervals behave
28	17.1	The reasoning of tests of significance
	17.2	Stating hypotheses
29	17.3	P-value and statistical significance
	17.4	Tests for a population mean
30	18.1	Conditions for inference in practice
	18.2	Cautions about confidence intervals
	18.3	Cautions about significance tests
	18.4	Planning studies: sample size for confidence intervals

MAT 1450 – INTRODUCTORY STATISTICS
THREE TIMES A WEEK SECTIONS CLASS SCHEDULE (*continued*)

Lecture	Sections	Topics
31	20.1	Conditions for inference about a mean
	20.2	The t distributions
	20.3	The one-sample t confidence interval
32	20.4	The one-sample t test
	20.5	Using technology
33	20.6	Matched pairs t procedures
	20.7	Robustness of t procedures
34		*Review*
35		**Test 3 (16,17,18,20)**
	21.1	Two-sample problems
	21.2	Comparing two population means
36	21.3	Two-sample t procedures
	21.4	Using technology
	21.5	Robustness again
37	22.1	The sample proportion p
	22.2	Large-sample confidence intervals for a proportion
38	22.3	Choosing the sample size
	22.4	Significance tests for a proportion
39	22.5	Plus four confidence interval for a proportion
40	25.1	Two-way tables
	25.2	The problem of multiple comparisons
	25.3	Expected counts in two-way tables
41	25.4	The chi-square test statistic
	25.5	Cell counts required for the chi-square test
	25.6	Using technology
42	25.7	Uses of the chi-square test
	25.8	The chi-square distributions
	25.9	The chi-square test for goodness of fit
43		Holiday/CatchUp[4]
44		*Review*
45		**Test 4 (21,22,25)**
		Finals Week
3 – 4 Class Periods		*Review*
1 – 2 Class Periods		**Comprehensive Final Exam**

General Notes for the Instructor

- "Holiday/CatchUp" days have been included to add flexibility to the course schedule and to reinforce course material. Class should be held on these days; unless the college is closed. Please use the guidelines below to assist in utilizing these days.

- GENERAL GUIDELINES: (TAGS)
  This is a course of study that introduces statistical thinking and statistical methods to students. The American Statistical Association has developed a set of six recommendations for the teaching of introductory statistics – these recommendations are known as the "Guidelines for Assessment and Instruction in Statistics Education." The recommendations are as follows:
  1. Emphasize statistical literacy and develop statistical thinking;
  2. Use real data;
  3. **Stress conceptual understanding rather than mere knowledge of procedures**;
  4. Foster active learning in the classroom;
  5. Use technology for developing conceptual understanding and analyzing data;
  6. Use assessments to improve and evaluate student learning;

- **Lab Activities**: Included in the General Guidelines document, it is stated that "Real data and hands-on projects should be incorporated throughout the course". MAT 1450 is a 4 hour lecture/lab course with 2 contact hours per week (100 min) set aside for students to work on various activities including the collecting of real data and working with the technology. To this end there are several lab activities, many incorporating the use of the computer that students should be working on regularly in the classroom.

- **Formulas for Chapter 12 and beyond**: It is up to the instructors to use discretion in deciding what formulas to be provided on exams for Chapters 12 and beyond.

- **Internship opportunities**: Please include the following paragraph in your course syllabi.

  STEM Internship Opportunities:
  Experiencing a **S**cience, **T**echnology, **E**ngineering or **M**athematics (STEM) internship is a great way to begin your career. Companies offer a verity of opportunities for students to practice what they learned in the classroom to solve real world of work problems. To learn more about STEM Internship Opportunities and how to connect your skills with a future employer, contact Chad R. Bridgman, M.S.M. Internship Coordinator for Science, Mathematics & Engineering by phone 937-512-2570, office (3-134), or email SMEinternships@Sinclair.edu, and test drive your future career today!

Suggested Formulas for MAT 1450 Introductory Statistics (7e)

Chapter 2

- Mean (use a calculator): $\bar{x} = \frac{x_1+x_2+\cdots+x_n}{n} = \frac{1}{n}\sum_{i=1}^{n} x_i$
- Standard deviation (use a calculator) $s = \sqrt{\frac{1}{n-1}\sum(x_i - \bar{x})^2}$
- Median: Arrange all observations from smallest to largest. The median M is located (n+1)/2 observations from the beginning of this list.
- Five Number Summary: Minimum, Q_1, M, Q_3, Maximum

Chapter 3

- The 68-95-99 rule
- Standardized value of x: $z = \frac{x-\mu}{\sigma}$

Chapter 4 and 5

- Least-squares regression line $\hat{y} = a + bx$
- Residual $= y - \hat{y}$

Chapter 12 and 13

- $0 \le P(A) \le 1$
- $P(S) = 1$
- P(A or B)=P(A)+P(B)-P(A and B)
- If events are disjoint, $P(A\ or\ B) = P(A) + P(B)$
- If events are independent, $P(A\ and\ B) = P(A)P(B)$
- For any event, P(A does not occur)=1-P(A)

Chapter 15

- Sampling distribution of a sample mean: $\bar{x}$ has mean μ and standard deviation $\frac{\sigma}{\sqrt{n}}$
- Central Limit Theorem

Chapter 16

- Z confidence interval for a population mean ($\sigma\ known, SRS$ from Normal population):

  $\bar{x} \pm z^* \frac{\sigma}{\sqrt{n}}$ $z^*$from N(0,1)

Chapter 17

- Z test statistic for $H_o: \mu = \mu_o$ ($\sigma\ known, SRS$ from Normal population):

  $z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}}$ $P - value$ from N(0,1)

Chapter 20

- t confidence interval for a population mean ($\sigma\ unknown$, SRS from Normal population):

  $\bar{x} \pm t^* \frac{s}{\sqrt{n}}$ $t^*$from t(0,1)

- t test statistic for $H_o: \mu = \mu_o$ ($\sigma\ unknown, SRS$ from Normal population):

  $t = \frac{\bar{x}-\mu}{s/\sqrt{n}}$ $P - value$ from t(0,1)

Chapter 21

- Two-sample t confidence interval for $\mu_1 - \mu_2$ (independent SRSs from Normal population):

  $(\overline{x_1} - \overline{x_2}) \pm t^* \sqrt{\frac{s_1{}^2}{n_1} + \frac{s_2{}^2}{n_2}}$ with conservative t* from t with df the smaller of $n_1 - 1$ and $n_2 - 1$.
- Two-sample t test statistics for $H_o: \mu_1 = \mu_2$ (independent SRSs from Normal population):

  $t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1{}^2}{n_1} + \frac{s_2{}^2}{n_2}}}$ with conservative P-values from t with df the smaller of $n_1 - 1$ abnd $n_2 - 1$.

Chapter 22

- Sampling distribution of a sample proportion when the population and the sample size are both large and p is not close to 0 or 1, $\hat{p}$ is approximately Normal with mean p and standard deviation $\sqrt{\frac{p(1-p)}{n}}$.
- $\hat{p} = \frac{number\ of\ successes}{n}$
- Large-sample z confidence interval for p: $\hat{p} \pm z^* \sqrt{\frac{p(1-p)}{n}}$ $z^*$from N(0,1)
- Plus four to greatly improve accuracy: use the same formula after adding 2 successes and two failures to the data. (denominator = n+4)
- Z test statistic for $H_o: p = p_o$ (large SRS): $z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_O(1-p_O)}{n}}}$ P-value from N(0,1)
- To find the sample size for desired margin of error, use a guessed value, p*=0.5

Chapter 25

- Expected count for a cell in a two-way table= $\frac{(column\ total)(row\ total)}{total\ total}$
- Chi-square test statistic for testing whether the row and column variables in an r x c table are unrelated (expected cell counts not too small):

$$X^2 = \sum \frac{(obs - \exp)^2}{exp}$$

With P-value from the chi-square distribution and df=(r-1)(c-1)