Class 1

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Department of Mathematics, Statistics, and Computer Science
Agenda:
Syllabus
Math Review
Lecture Chapter 1
Syllabus
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Department of Mathematics,
Statistics, and Computer Science
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Marquette University

Syllabus
Fall 2013

Course: MATH 1700
Time: 12:30 am - 1:45 pm TuTh
Instructor: Daniel B. Rowe, Ph.D.
MATH 1700

Description: Fundamental theory and methods of statistics without calculus. Descriptive statistics, elements of probability theory, estimation, tests of hypotheses, regression, correlation, introduction to computer methods of statistical tabulation and analysis. This course is recommended for students seeking a general introduction to statistical concepts and is not intended to be a final course in statistics for students who need a thorough working knowledge of statistical methods.

Prereq: MATH 105 or equivalent. Equivalent is two years of college preparatory mathematics. May not be taken for credit by students who have received college credit for another probability or statistics course.

Calculators: You will need some sort of scientific calculator for the course. Will use during exams.

Homework: Homework assignments will be given but will not be collected, but exams will go more smoothly if you have done the homework.
Grading: 6 exams given throughout the semester. No make-ups, if none missed then lowest dropped. If “unavoidable absence” as defined in Arts and Sci. Undergrad Bulletin, then % added to final %.

Midterm Exams 75% (15% each), Final Exam 25%

Grade Scale:

\[
\begin{align*}
94\% \leq x & \leq 100\% \text{ (A)} \\
88\% \leq x & < 94\% \text{ (AB)} \\
83\% \leq x & < 88\% \text{ (B)} \\
77\% \leq x & < 83\% \text{ (BC)} \\
73\% \leq x & < 77\% \text{ (C)} \\
67\% \leq x & < 73\% \text{ (CD)} \\
63\% \leq x & < 67\% \text{ (D)} \\
x & < 63\% \text{ (F)}
\end{align*}
\]

Drop Date: Last day without a W 9/3/2013, with a W 11/15/13.
Exams every few of weeks:
Final Exam: December 13, 8:00 am – 10:00 am.

**TA:** Muge Karaman
**Office Hours:** TuTh 11:30 am – 12:30 am
**Office:** Cudahy Hall 357
**Email:** meryem.karaman@marquette.edu

**Instructor:** Daniel B. Rowe, Ph.D.
**Office Hours:** TuTh 1:45 – 2:45 pm
**Office:** Cudahy Hall 313
**Email:** daniel.rowe@marquette.edu
ROLES

Professor: Required to use this book and cover material in it. Explain and answer questions on the material. Assess your knowledge of material through exams.

TA: Work through homework problems and grade exams.

Student: Learn material by attending class or reading book. Ask Professor questions on material and mechanics. Ask TA questions on mechanics of problems. Demonstrate mastery of material and mechanics of problems on exams.
RESOURCES

Lecture: Professor, explanation of material and examples. (50 min) This is the scheduled class time.

Discussion: TA, answer questions work homework problems. (25 min) Scheduled class time, no excuse for not attending. If something in lecture not crystal clear, ask TA!

Office Hours: TA, 2 per week before class. Professor, 2 per week two are after class. If something not clear after lecture or discussion or need help on homework then come! Come for any reason!

Email: Send TA or Professor email.
Algebra Review

1. Summation Notation
2. Factorials
3. Computations
4. Simple Linear Equations
1. Summation Notation
We use symbols to indicate general math operations
Let \( x_1, x_2, \ldots, x_n \) and \( y_1, y_2, \ldots, y_n \) be two sets of numbers.

The following notation will be used in course:

\[
\sum_{i=1}^{n} x_i = x_1 + x_2 + \ldots + x_n
\]

\[
\sum_{i=1}^{n} x_i^2 = x_1^2 + x_2^2 + \ldots + x_n^2
\]

\[
\left( \sum_{i=1}^{n} x_i \right)^2 = (x_1 + x_2 + \ldots + x_n)^2
\]

\[
\sum_{i=1}^{n} x_i y_i = x_1 y_1 + x_2 y_2 + \ldots + x_n y_n
\]

Examples to follow:
1. Summation Notation

Example: \( x_1, x_2, ..., x_n \)

Given numbers: 2, 1, 3.

We have three numbers
\( n = 3 \)

We associate each number with an \( x \) as:
\( x_1 = 2, \ x_2 = 1, \ x_3 = 3 \)
1. Summation Notation

\[ n = 3 \]
\[ x_1 = 2, \ x_2 = 1, \ x_3 = 3 \]

When we write

\[ \sum_{i=1}^{3} x_i = x_1 + x_2 + x_3 \]

What we mean is

\[ \sum_{i=1}^{3} x_i = 2 + 1 + 3 = 6 \]
1. Summation Notation

$n=3$

$x_1=2$, $x_2=1$, $x_3=3$

When we write

$$\sum_{i=1}^{3} x_i^2 = x_1^2 + x_2^2 + x_3^2$$

What we mean is

$$\sum_{i=1}^{3} x_i^2 = 2^2 + 1^2 + 3^2 = 14$$
1. Summation Notation

\[ n = 3 \]
\[ x_1 = 2, \ x_2 = 1, \ x_3 = 3 \]

When we write

\[
\left( \sum_{i=1}^{3} x_i \right)^2 = \left( x_1 + x_2 + x_3 \right)^2
\]

What we mean is

\[
\left( \sum_{i=1}^{3} x_i \right)^2 = \left( 2 + 1 + 3 \right)^2 = 36
\]
1. Summation Notation

$n=3$

$x_1=2$, $x_2=1$, $x_3=3$ and $y_1=1$, $y_2=2$, $y_3=3$

When we write

$$\sum_{i=1}^{3} x_i y_i = x_1 y_1 + x_2 y_2 + x_3 y_3$$

What we mean is

$$\sum_{i=1}^{3} x_i y_i = 2 \times 1 + 1 \times 2 + 3 \times 3 = 13$$
2. Factorials
A factorial is a multiplication process.

$n$ factorial is written symbolically as $n!$

and means $n! = n \times (n - 1) \times (n - 2) \times \cdots \times 2 \times 1$

Example:

$3! = 3 \times 2 \times 1 = 6$
2. Factorials
A factorial is a multiplication process.

\[ n! = n \times (n-1) \times (n-2) \times \cdots \times 2 \times 1 \]

Example:
\[ 3! = 3 \times 2 \times 1 = 6 \]

Your turn!
\[ 5! = ? \]
3. Computations
Suppose $x=20$, $y=14$, $s=16$, $w=-2$, $m=15$, $n=10$.

Compute $x + 2y - 4w$
3. Computations
Suppose $x=20$, $y=14$, $s=16$, $w=-2$, $m=15$, $n=10$.

Compute $x + 2y - 4w$

Solution

\[ = 20 + 2(14) - 4(-2) \]
\[ = 20 + 28 + 8 \]
\[ = 56 \]
3. Computations

Suppose $x=20$, $y=14$, $s=16$, $w=-2$, $m=15$, $n=10$.

Compute $x + 6w - 4s$
3. Computations
Suppose $x=20$, $y=14$, $s=16$, $w=-2$, $m=15$, $n=10$.

Compute $x + 6w - 4s$

Solution

\[
\begin{align*}
&= 20 + 6(-2) - 4(16) \\
&= 20 - 12 - 64 \\
&= -56
\end{align*}
\]
3. Computations
Suppose $x=20$, $y=14$, $s=16$, $w=-2$, $m=15$, $n=10$.

Compute $x + y \cdot \frac{\sqrt{s}}{n}$
3. Computations

Suppose \( x=20, \ y=14, \ s=16, \ w=-2, \ m=15, \ n=10. \)

Compute \( x + y \cdot \sqrt{s} \div n \)

Solution

\[
= 20 + 14 \cdot \frac{\sqrt{16}}{10} \\
= 20 + 14 \cdot \frac{4}{10} \\
= 20 + \frac{56}{10} \\
= 25.6
\]
3. Computations
Suppose $x=20$, $y=14$, $s=16$, $w=-2$, $m=15$, $n=10$.

Compute $\sqrt{\frac{1}{n} + \frac{1}{m}}$
3. Computations

Suppose \( x=20, \ y=14, \ s=16, \ w=-2, \ m=15, \ n=10. \)

Compute \( \sqrt{\frac{1}{n} + \frac{1}{m}} \)

Solution

\[
= \sqrt{\frac{1}{10} + \frac{1}{15}}
= \sqrt{\frac{1}{10} \cdot \frac{3}{3} + \frac{1}{15} \cdot \frac{2}{2}}
= \sqrt{\frac{5}{30}} = \sqrt{\frac{1}{6}} = 0.4082
\]
3. Simple Linear Equations
Find $x$ for:

$$1 - x = 0.23$$
3. Simple Linear Equations

Find $x$ for:

$$1 - x = 0.23$$

Solution:
Subtract 1 from both sides:

$$-x = 0.23 - 1$$

$$-x = -0.77$$

Multiply both sides by -1:

$$-x = -0.77$$

$$x = 0.77$$
3. Simple Linear Equations

Find $x$ for:

$$2 - 2x = 3x + 3$$
3. Simple Linear Equations

Find $x$ for:

$$2 - 2x = 3x + 3$$

Solution:
Add $2x$ to both sides:

$$2 - 2x + 2x = 3x + 3 + 2x$$

$$2 = 5x + 3$$

Subtract 3 from both sides:

$$2 - 3 = 5x + 3 - 3$$

$$-1 = 5x$$

Divide both sides by 5:

$$x = -\frac{1}{5}$$
Lecture Chapter 1
Chapter 1: Statistics

Daniel B. Rowe, Ph.D.

Department of Mathematics, Statistics, and Computer Science
1: Statistics
1.1 Americans Here’s Looking at you

Statistics is all around us!

How much time between Internet usage?

Figure from Johnson & Kuby, 2012.
1: Statistics

1.1 Americans Here’s Looking at you

We are presented statistics from a variety of topics.

How often is your bed made?

Four percent of women say never, and 2% say only when company comes. Other responses:

- Daily or more often: 76%
- Every 2–6 days: 10%
- Weekly: 5%
- Less than weekly: 2%

Source: Consumer Reports National Research Center survey of 1,008 women. Margin of error ±3.2 percentage points.

Figure from Johnson & Kuby, 2012.
1: Statistics
1.1 Americans Here’s Looking at you

We are presented statistics from a variety of topics.

**Applied Example 1.1**

**FISH’S AGE**

<table>
<thead>
<tr>
<th>Length, in.</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yrs.</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**HOW OLD IS MY FISH**

Average age by length of largemouth bass in New York State.

*Source: NYS DEC Freshwater Fishing Guide*

Forget about my dad’s and my grandpa’s age, I just want to know, “How old is my fish?” How does that work? **Statistics!** You will learn about “averages” in Chapter 2. This information also seems to imply that if the fish’s length is measured, the fish’s age is then known. Additional statistical techniques can be used to describe the relationship between the fish’s age based on the fish’s length, and as a result age can be estimated. You will learn about the statistical method for data like this in Chapter 3.

Figure from Johnson & Kuby, 2012.
1: Statistics
1.1 What is Statistics?

Statistics is the universal language of science and we need to master both the “science” and “art” of using statistical methodology correctly.

These methods include

(1) carefully defining the situation,
(2) gathering data,
(3) accurately summarizing the data,
(4) deriving and communicating meaningful conclusions.

Statistics involves numbers and graphs to summarize the information contained in a set of data, then interpreting this information.
1: Statistics
1.1 What is Statistics?

The field of statistics can be divided into two main branches.

**Descriptive statistics** which involves the collection, presentation, and description of sample data. This is where we describe the information contained in a set of data.

**Inferential statistics** which involves the interpretation of the values from the descriptive techniques and making decisions and drawing conclusions about a population of data. This is where we infer from the sample back to the larger population. i.e. population has similar properties as sample.
1: Statistics
1.1 What is Statistics?

**Statistics:** The science of collecting, describing, and interpreting data.

**Population:** A collection, or set, of individuals, objects, or events whose properties are to be analyzed.

**Sample:** Subset of the population.

**Variable:** A characteristic of interest about each individual element of a population or sample.

**Data value:** The value of the variable associated with one element of a population or sample. (number, a word, or a symbol)
1: Statistics
1.1 What is Statistics?

**Data:** The set of values collected from the variable from each of the elements that belong to the sample.
1: Statistics
1.1 What is Statistics?

**Data:** The set of values collected from the variable from each of the elements that belong to the sample.

**Experiment:** A planned activity whose results yield a set of data.

**Sample:** Subset of the population.

**Parameter:** A numerical value summarizing all the data of an entire population.

**Statistic:** A numerical value summarizing the sample data.
1: Statistics
1.1 What is Statistics?

**Qualitative variable:** A variable that describes or categorizes an element of a population.

**Nominal variable:** A qualitative variable that characterizes an element of a population. No ordering. No arithmetic.

**Ordinal variable:** A qualitative variable that incorporates an ordered position, or ranking.
Quantitative variable: A variable that quantifies an element of a population.

Discrete variable: A quantitative variable that can assume a countable number of values. Gap between successive values.

Continuous variable: A quantitative variable that can assume an uncountable number of values. Continuum of values.
1: Statistics

Questions?

Homework: Read Chapters 1 and 2.
Chapter 1 Problems: 7, 9, 11, 41, 49a
vocabulary on page 27