AMS 4 - Lecture 4/17/18

THISTIME: Normal Curve
NEXT time: Experimental Design

Resources

* MSI Sessions (Evan Hetland)
  L ehetland@ucsc.edu

SCHEDULE

<table>
<thead>
<tr>
<th>Days</th>
<th>Times</th>
<th>Location</th>
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<tbody>
<tr>
<td>Mondays</td>
<td>4-5pm</td>
<td>OLC</td>
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<tr>
<td>Tuesdays</td>
<td>11:40AM - 12:40PM</td>
<td>OLC</td>
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<tr>
<td>Thursdays</td>
<td>1:30 - 2:30PM</td>
<td>Crown 2011</td>
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<tr>
<td>Fridays</td>
<td>1:20 - 2:20PM</td>
<td>OLC</td>
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LSS Tutoring
L suggsupport.ucsc.edu or lss.ucsc.edu

OFFICE HOURS
L TAs & Professor Draper

Data Analysis

L-163) Question: What percent of the butterflies had wing length \( \leq 3.56 \text{ cm} \)?

L Answer 1 (exact):
  From the raw data, \( \frac{2}{24} = \frac{1}{12} \approx 8.3\% \)

L Answer 2 (approx.):
  Draw histogram on density scale and work out area under histogram bars to left of 3.56cm

L Answer 3 (approx.):
  Impose a normal curve on top of the histogram on the density scale

SDS = 0.29 cm

What is the area under normal curve?
2.

* SD cannot be negative

\[ 12 \]
\[ 12 \]
\[ \vdots \]
\[ 12 \]

SD = 0
mean = 12

\[ \begin{bmatrix} 12 & c \\ c & c \end{bmatrix} \]

SD = 0
mean = c

\[ -\infty < \bar{y} < +\infty \]

→ Standard Normal Curve

\[ 68\% = 0.68 \]
SD = 1

Mean

Standard units (su)
axis = \( \bar{z} \) (z scores)

Math Fact: All normal curves satisfy the Empirical Rule exactly.

* Two facts about Normal Curve

1. Area under curve (total) = 1 or 100%.
2. Symmetric Bell curves

Negative Z-table

\[ Z = 1.00 \]

0.1587 = 16.1%

Left

16%

16%

16%

16%

Positive Z-table

0.8413 = 84%

100% - 84% = 16%

0.1587 = 15.9% = 16%
Wing length example

\[ y = \frac{3.50 \text{ cm} - 4.0 \text{ cm}}{0.29 \text{ cm}} = \frac{-0.52}{0.29} = -1.52 \]

Compare relationship of numbers

To get from raw units to standard units (y to z):

\[ z = \frac{y - \bar{y}}{s} \]

\[ y = \bar{y} + s \cdot z \]

Chapter 2: Experimental Design

Read article from R-41 \( \rightarrow \) R-50 (recommended)

L Chemical & Anatomical Chemistry of Brain

2.1 Randomized Controlled Experiments

Case study \( \rightarrow \) Psychobiology

Does the psychological environment affect the anatomy of the brain in mammals?
\( Y = \text{Brain anatomy (outcome)} \)
\( X = \text{Psychological environment (treatment)} \)

* \( Y \rightarrow \text{dependent variable} \)
* \( X \rightarrow \text{independent variable} \)

Can't experiment on people (manipulate) due to ethics
Can run a survey & ask people, with informed consent, about \( X \), & do brain scan to see their \( Y \)

Subjects: rats (\( n=120 \))

\( Y \rightarrow \text{Weight of cortex in mg (quant. & continuous)} \)
\( X \rightarrow \text{enriched (T) vs. deprived (C)} \)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cortex Weight</th>
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<tr>
<td>Enriched</td>
<td>( \bar{Y}_1 = 683 \text{mg} )</td>
</tr>
<tr>
<td>Deprived</td>
<td>( \bar{Y}_2 = 647 \text{mg} )</td>
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*Does 683 differ from 647 by an amount that's large in practical terms?*

\[
\frac{683\text{mg} - 647\text{mg}}{647\text{mg}} = \frac{36}{647} = 0.0556\text{ mg}
\]

5.6% \( \rightarrow \) T Bigger than C