This time: measurement error; prob. models for means

Next time: statistical models for means; interval estimation

Read: DD (B) ch.11 LN: pp. L-137-156 This time: LN pp. L-127 →

3.9 is more useful than # is > 3.5

weighing butter:

$$\begin{bmatrix} 16 \text{ oz} \\ 16 \text{ oz} \\ 16 \text{ oz} \\ \vdots \end{bmatrix} \qquad \begin{bmatrix} 16.0 \\ 16.0 \\ 16.0 \\ \vdots \end{bmatrix} \qquad \begin{bmatrix} 16.01 \\ 15.98 \\ \vdots \\ 15.99 \end{bmatrix}$$

deterministic (same value everytime) — probabilistic (stochastic) (different value every time)

$\boxed{\text{Basic Model}}$

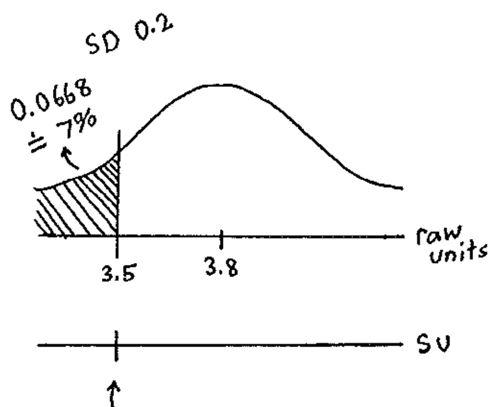
$$\begin{pmatrix}\text{obs. } 1 \\ y_1\end{pmatrix} = (\overset{\theta \,\leftarrow\, \text{theta}}{\text{true value}}) + (\text{bias}) + (\text{random error } 1)$$

$$\begin{pmatrix}\text{obs. } 2 \\ y_2\end{pmatrix} = (\text{true value}) + (\text{bias}) + (\text{random error } 2)$$

$$\vdots \qquad\qquad \vdots \qquad\qquad \vdots \qquad\qquad \vdots$$

mean 0 Independent IID

chart on other page

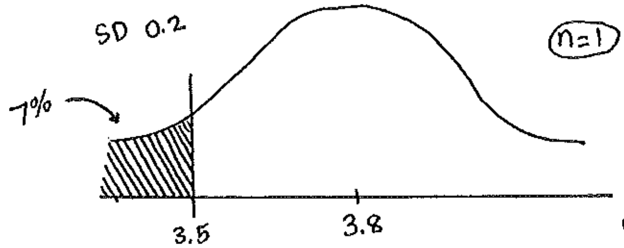


pop. hist.

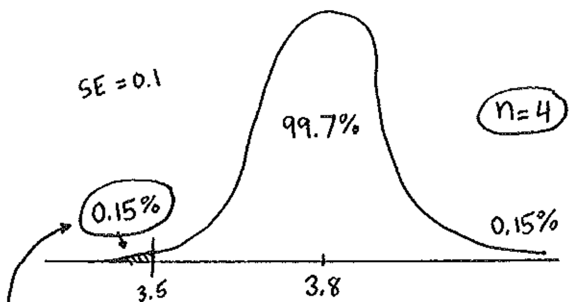
(1 reading at a time)

$P(\text{misclassification}) = P(y_1 > 3.5)$ ← saying you're hypo. when not true

$$\frac{3.5-3.8}{0.2} = -\frac{0.3}{0.2} = -1.50 \quad \text{check L-34/35}$$



long run hist. of $\bar{y}$



← less spread out

$$\frac{3.5-3.8}{0.1} = -3$$

P(misdiagnosis w/n = 4) = 0.15%

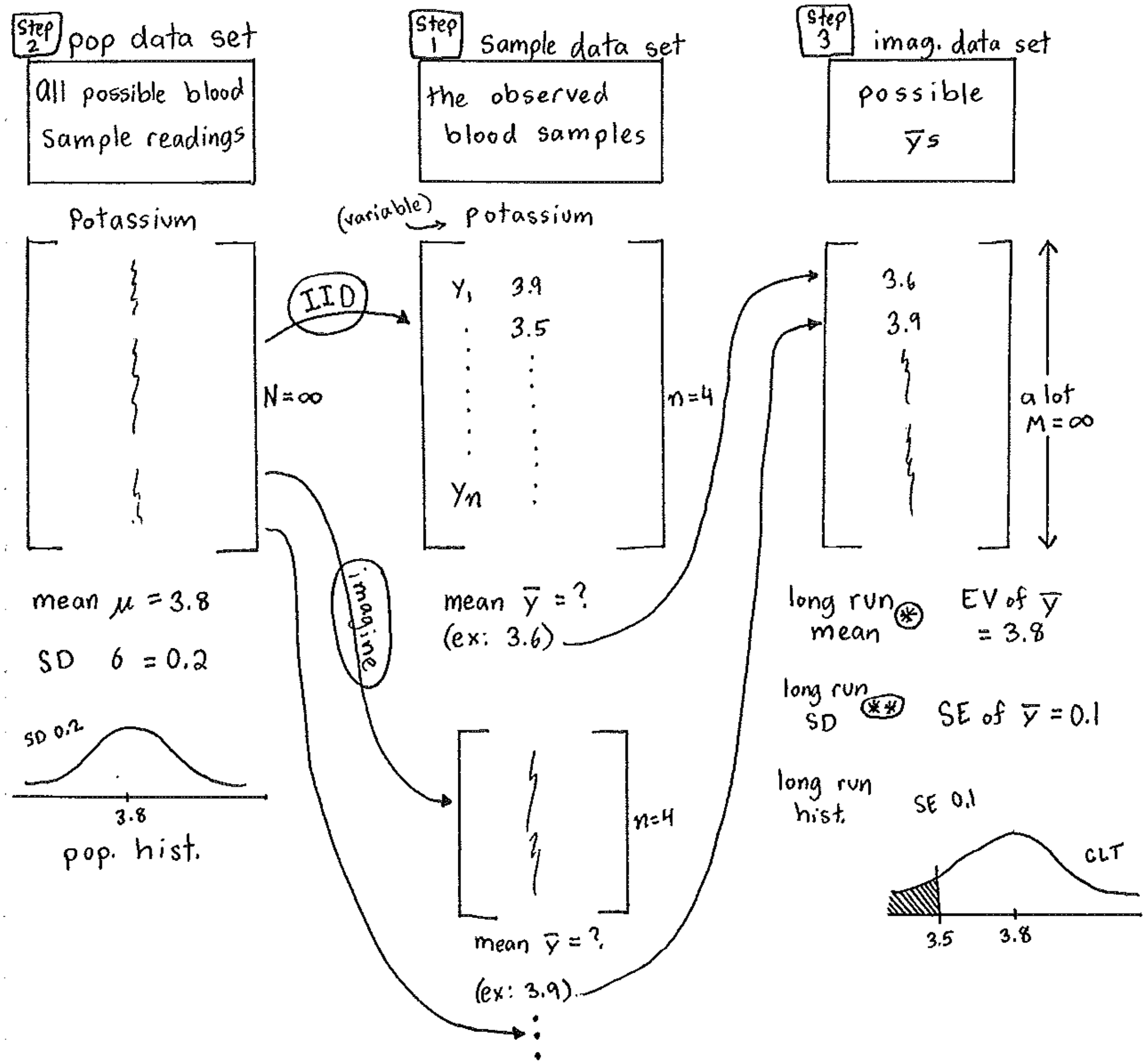
n	error rate	cost
1	7%	\$25
4	0.15%	\$100

big n leads to larger cost

benefit (small error rate with big n)

Would you pay \$25 for a 7% chance to eat more bananas than you needed to?

conceptual



⊛ expected value of $\bar{y}$

= EV of $\bar{y}$

$= E(\bar{y})$

$= E_{IID}(\bar{y}) = ?$

math fact: $\boxed{E_{IID}(\bar{y}) = \mu}$

⊛⊛

N	no
μ	no
$\sigma \uparrow$	$SE(\bar{y}) \uparrow$
$n \uparrow$	$SE(\bar{y}) \downarrow$

long run SD of $\bar{y}$ = standard error of $\bar{y}$

= SE of $\bar{y}$ $= SE(\bar{y}) = SE_{IID}(\bar{y}) = ?$

math fact: $\boxed{SE_{IID}(\bar{y}) = \frac{\sigma}{\sqrt{n}}}$

Square root law: to cut the SE in half, you have to quadruple the sample size.

here $SE(\bar{y}) = \frac{0.2}{\sqrt{4}} = 0.1$