this time: probability models

next time: sums and means

read: (1) A ch. 1-3; B ch. 1-10 LN pp. 1-136 (1)

quiz 4 due tonight

STAT 2 29 Oct 19

homework 2: new due date: this Thu night 31 Oct

today: LN pp. 113→ (R-37), R-51, R-52

$$P(Y) = \frac{81}{106} \doteq 76\%$$

$$P(Y \mid F) = \frac{29}{49} \doteq 59\%$$

$$P(Y \mid M) = \frac{52}{57} \doteq 91\%$$

Q1 (not indep! association between gender (G) & MLP, or are they (independent)? (A) (G), (MLP) strongly dependent (strong association exists)

death penalty ↓

$P(DP) = \frac{36}{326} \doteq 11.0\%$ (DP or no DP = outcome)

def. white ↓

$P(DP \mid DW) = \frac{19}{160} \doteq 11.9\%$ (DW or DB = treatment)

$P(DP \mid DB) = \frac{17}{166} \doteq 10.2\%$

assoc.? yes: (DB → DW) DP ↑ (!)

(R-52) Roulette | P(coming out ahead, 1 play Ⓐ) $= \frac{1}{38} \doteq 2.5\%$

ELM? yes

P(ditto Ⓑ) $= \frac{2}{38} \doteq 5\%$

~~real world (natural language)~~ (ambiguous)

your net gain after 1,000 \$1 bets on a single # is like the sum of n = 1,000 IID draws from pop. P

math world — less ambiguous

p pop. / sample / prob. model for

possible spins / the observed spins / (A) single # [6] imaginary all lottery possible values

your net gain | quant.

$N = 38$

$	
−1	0
−1	00
⋮	1
	⋮
−1	5
+35	6
−1	7
⋮	⋮
−1	36

"mean" pop. mean $\mu = \$-0.05$

pop. SD $\sigma = \$5.76$

lower case sigma

pop. hist.

= IID (at random with repl.)

your net gain

y_1 −$1
−$1
y_2 +$35
⋮
y_n

$n = 1000$

sum S = ? (ex. $ −61)

IID

$n = 1{,}000$

sum S = ? (ex. $ −25)

⋮

$ −61
$ −25
⋮

big $M \to \infty$

(in "too") long-run mean / expected value of

$S' = E_{IID}(S) = \$-52$

long-run SD / standard error of $S \doteq \$182$

long-run hist

R-53-54

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{n} y_i = \frac{S}{n}$$

← S

(4)

$$\mu = \frac{\overbrace{(-\$1) + \dots + (-\$1)}^{37} + \overbrace{(+\$35)}^{1}}{38}$$

$$= \frac{-\$2}{38} = \boxed{-\$0.05} \leftarrow$$

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on any single \$1 bet, you expect to win $\boxed{(-\$0.05) = \mu}$,

give or take about \$5.76 (σ)

\$5.76

$\sigma = ?$

math fact: if pop. has only 2 values in it,

$$\sigma = \left(\underbrace{\begin{pmatrix}\text{larger}\\\text{value}\end{pmatrix}}_{(+\$35)} - \underbrace{\begin{pmatrix}\text{smaller}\\\text{value}\end{pmatrix}}_{(-\$1)} \right) \sqrt{ \underbrace{\begin{pmatrix}\text{proportion}\\\text{of larger}\\\text{values}\end{pmatrix}}_{\frac{1}{38}} \underbrace{\begin{pmatrix}\text{prop.}\\\text{of smaller}\\\text{values}\end{pmatrix}}_{\left(\frac{37}{38}\right)} }$$