this time: prob. models for sums

read: DD (B) ch. 9 – 11

AMS 7 20 oct 15

next time: prob., stat. models for means

LN: pp. L-127 – 156

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today: LN pp. L-119 → 127

can turn in homework 2 by midnight tomorrow in box outside Baskin 357c

probability models for sums

$\boxed{(A)}$ P(coming out ahead on single play) = $\frac{1}{38}$

(B) P(———) = $\frac{2}{38} = \frac{1}{19} \doteq 5\%$

$\doteq 2.5\%$

P(coming out ahead in 1,000 spins with (A)

$= P(S > \$0) = ?$

pop. mean $\mu = \frac{\overbrace{(-\$1) + \ldots + (-\$1)}^{37} + (+\$35)}{38} = \frac{-\$2}{38} = -\$0.0526$

A 6 ②

pop. data set

all outcomes of $1 bet

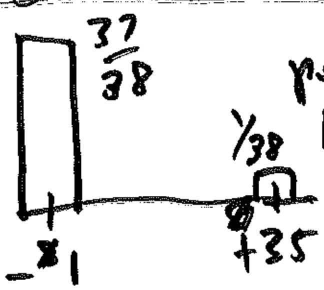
your net gain

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

N = 38

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

pop. SD $\sigma = \$5.76$



pop. hist.

sample data set

the observed single-bet outcomes

your net gain

−$1
−1
$ +35
−1
$ −1

IID

n = 1,000

sum S = ? (ex. −$61)

IID

n = 1,000

sum S = ? (ex. −$25)

⋮

n = 1000

sum S = ? (ex. $+11)

(≈$6)

(≈30)

imaginary data set

possible values of S

−$61
−25
⋮
+11
⋮
−$61

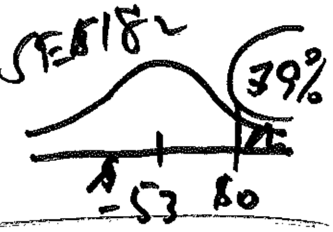
n = +∞

long run mean $E(S) = n\mu = -\$53$

long run SD $SE(S) = \$182$

long run hist

SE $182



$$\frac{(\$0) - (-\$53)}{\$182} = +0.29$$

here

$E(S) = n\mu$

$= (\$1000)(\$-0.05)$

$\doteq -\$53$

here $SE(S)$

$= \sigma\sqrt{n} = (\$5.76)\sqrt{1000} = \$182$

f.52

$$\sigma = \sqrt{\frac{\underbrace{\left((-\$1) - (-\$0.05)\right)^2 + \dots + \left[(-\$1) - (-\$0.05)\right]^2}_{37} + \left[(+\$35) - (-\$0.05)\right]^2}{38}}$$

$$\doteq \$5.76$$

long-run mean of S_n (sum)

= expected value of S =

$\text{EV of } S = E(S) = E_{IID}(S) = \, ?$

math fact

$$\boxed{E_{IID}(S_n) = n \cdot \mu}$$

n IID draws

$= \left(\begin{matrix}\#\text{ of}\\ \text{draws}\end{matrix}\right) \cdot \left(\begin{matrix}\text{pop}\\ \text{mean}\end{matrix}\right)$

from a pop. with mean μ

long run SD of $\hat{\delta}$ = standard error of $\hat{\delta}$

$= SE(\hat{\delta}) = SE_{IID}(\hat{\delta}) = \ ?$

\$ \$

N	no
μ	no
$\sigma\uparrow$	SE$\uparrow$
$n\uparrow$	SE$\uparrow$

$$\underset{\$}{SE} = \frac{\sigma\sqrt{n}}{1}$$

our uncertainty about $\hat{\delta}$

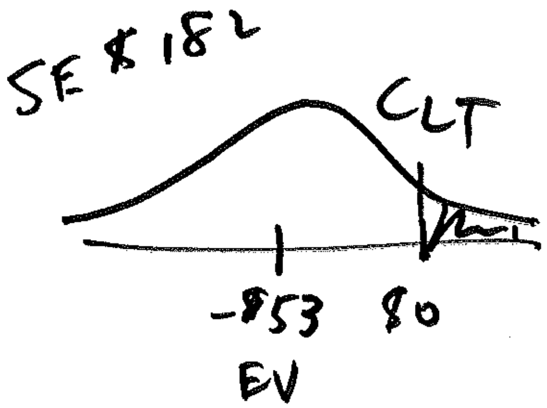
math fact $SE_{IID}(\hat{\delta}) = \sigma\sqrt{n}$

pop SD

$\sqrt{\#\text{draws}}$

signal $\leftrightarrow$ expected value

noise $\leftrightarrow$ standard error



long-run hist of $\hat{\delta}$