May 5, 2017

This time: probability models for sums + means

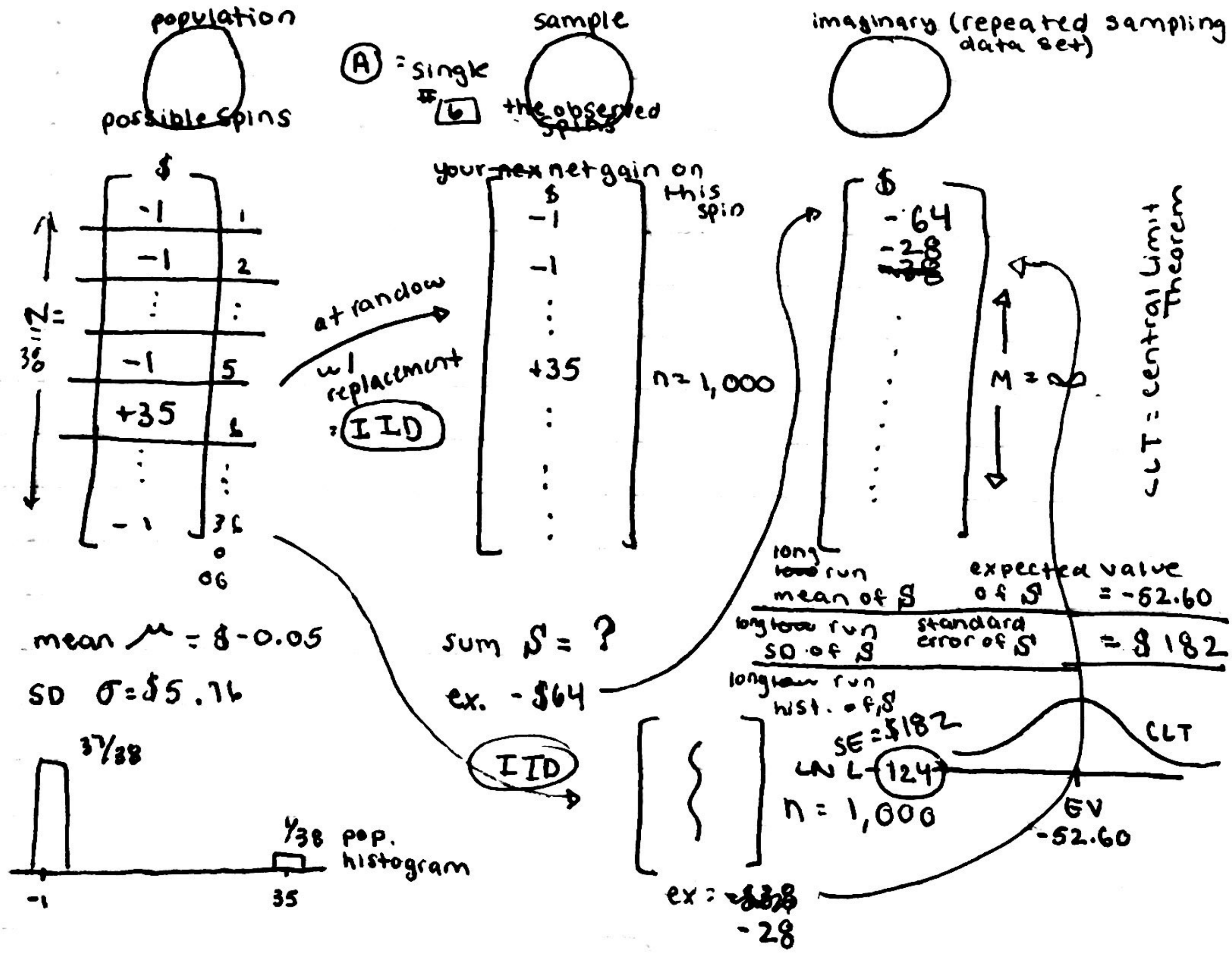
Next time:

read: OD ch. 11

LN pp. L 127–144

today: LN L-119 →

How to solve problems: find a problem whose solution you already know that's similar to the new problem you are working on + adapt the solution to the old problem to solve the new one.



your net gain after n = 1,000 spins of roulette wheel + n = 1,000 # $1 bets on a single # $\boxed{\text{is like}}$

the sum of n = 1,000 RFD draws from the population ⊛

the model

expect around $\frac{1{,}000}{38}$ = 26 wins, each winning up \$35, so we expect to win (26)(35) = \$910, but we therefore also expect to loose 1,000 - 26 = 974 times for a total loss of -\$974; the difference is \$910 - 974 = -\$64

P(coming out ahead) = $P(S' > \$0)$

$\left(\text{long-run mean of } S\right) = \left(\begin{matrix}\text{expected} \\ \text{value} \\ \text{of } S\end{matrix}\right) = \text{EV of } S'$

$= \boxed{E_{IID}(S) = n \cdot \mu}$ $= (1{,}000)(-\$0.05)$
$= \$-52.60$

$\left(\text{long run SD of } S'\right) = \left(\begin{matrix}\text{standard} \\ \text{error} \\ \text{of } S\end{matrix}\right)$

$= SE \text{ of } S' = SE_{IID}(S) = \frac{\sigma\sqrt{n}}{1} = \cancel{\sigma\sqrt{n}}\ \sigma\sqrt{n}$

N	X
μ	X
σ ✓	as $\sigma\uparrow$ $SE(S)\uparrow$
$M = \infty$	X
n ✓	as $n\uparrow$ $SE(S)\uparrow$

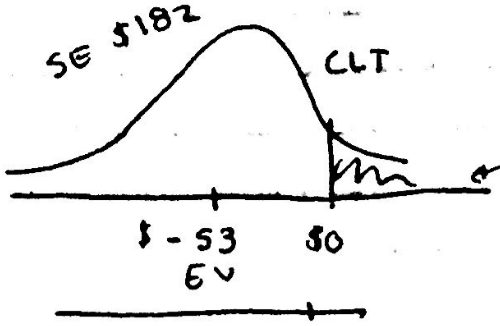
standard error of S = amount of uncertainty we have about S before the random draws have been made

σ = uncertainty in a single draw

uncertainty = noise

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

If I make 1,000 \$1 bets on a single #, I expect at end to be behind by about \$53 ($E(S') = \$-53$), give or take about \$182



long-run hist of S'
using n = 1,000

$$\frac{\$0-(-53)}{\$182} = \frac{53}{182} = +0.29 = 39\%$$

P(coming out ahead w/ strategy A) = P(S', $0)
= 39%.