Class Notes

this time: probability models for sums
next time: probability models for averages

- homework #3 due Wed, May 3
- takehome midterm handed out Wed, May 3, due Wed, May 10
- reading: (DD) ch 10
  - FPP ch 18

[p 83] Case Study 8 — "Roulette"

population

<table>
<thead>
<tr>
<th>possible outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X: 1, 1, 1, 1, 1</td>
</tr>
<tr>
<td>N = 38</td>
</tr>
</tbody>
</table>

my net gain

\[
\begin{bmatrix}
-1 \\
-1 \\
-1 \\
-1 \\
+35
\end{bmatrix}
\rightarrow
\begin{bmatrix}
y_1 \\
y_2 \\
\vdots \\
y_n
\end{bmatrix}
\text{N=1000}

S = \begin{bmatrix}
-28 \\
+93
\end{bmatrix}
M \to \infty

S (net gain after 1000 spins) = \sum y_i - 28

\text{expected gain} = \sum \frac{y_i}{N} - 28

- mean \( (\mu) = \frac{-1-1-...-1+35}{38} = \frac{35}{38} - 0.05 \)

- SD \( (\sigma) = \sqrt{\frac{(1-0.05)^2 + ... + (35-0.05)^2}{38}} \approx 5.76 \)

- histogram:

\[
\begin{array}{c}
\text{histogram} \\
\text{bars}
\end{array}
\]

\[ y_i \]

\[ 2, 7, 0.05 \]

\[ 15, 15 \]

\[ 15 \]

\[ 15 \]

\[ 15 \]

\[ 15 \]

P(coming out ahead after 1000 spins) \geq P(S > 0)

\[ P(\text{coming out ahead after single play}) = \frac{1}{38} \]

long run mean of \( S \) (expected value of \( S \)) = EV of \( S \) = E(\( S \))

\[ E_{100}(S) = N \times \mu = \text{(# draws)} \times \text{(mean)} \]

\[ E_{100}(S) = -5.2 \]
long run SD = standard error of S = SE(S) =

\[ S_{\text{IID}}(S) = \sigma \sqrt{n} \]
\[ \Rightarrow \sigma \uparrow \text{SE}(S) \uparrow \]
\[ n \uparrow \text{SE}(S) \uparrow \]