How much can I expect to win or lose in 100 plays, betting $1 on odds?

Expected Value

\[
\text{Expected Value} = \frac{18 \times 1 + 20 \times (-1)}{38} = \frac{18 - 20}{38} = \frac{-2}{38} = -0.0526
\]

\[
100 \times -0.0526 = -5.26
\]

SD for "two-types-of-tickets" boxes:

\[
\text{SD}_{\text{sum}} = \text{SD}_{\text{box}} \sqrt{\text{draws}}
\]

\[
= 1 \times \sqrt{\frac{\text{fraction of large} \times \text{fraction of small}}{\text{tickets}}} \times \sqrt{100}
\]

\[
= 2 \times \sqrt{\frac{18}{38} \times \frac{20}{38}}
\]

\[
= 2 \times \sqrt{0.4737 \times 0.5263}
\]

\[
= 2 \times \sqrt{0.2536}
\]

\[
= 2 \times 0.4993 = 0.9986 \approx \$1
\]
**Expected Value and Standard Error**

\[ EV_{\text{sum}} = (\text{average of box}) \times (\text{number of draws}) \]

Observed sum of the draws = \[ EV_{\text{sum}} + \text{chance error} \]

\[ SE_{\text{sum}} = (SD_{\text{box}})(\sqrt{\text{# of draws}}) \]

\[ \text{avg}_{\text{box}} = -$0.05 \quad : \quad \text{The avg amount we can lose per play of game - lose 5 cents per$1 play.} \]

\[ SD_{\text{box}} = $1 \quad : \quad \text{give or take$1.} \]

\[ EV_{\text{sum}} = -$5.26 \quad : \quad \text{The avg amount we can expect to lose in 100 plays,} \]

\[ \text{BB}_{\text{sum}} = $10 \quad : \quad \text{give or take$10.} \]

\[ SE_{\text{sum}} \]
Find the probability of breaking even or better on 100 plays, betting $1 on odds.

\[
z = \frac{\text{obs} - \text{exp}}{\text{SE}}
\]

\[
z = \frac{0 - (-5.26)}{10} = \frac{5.26}{10} = .53
\]

1. Set up a box model
2. Compute avg_box, SD_box, EV_sum, SE_sum
3. Draw the normal curve:
4. Standardize (find the Z-score): 
   \[
z = \frac{\text{obs} - \text{exp}}{\text{SE}}
\]
5. Get area; compute area (probability) for the problem.