# Formulas

Root Mean Square

$$r.m.s. = \sqrt{\text{ average of } (entries^2)}$$

Standard Deviation

$$SD = (\text{big number} - \text{small number}) \times \sqrt{\text{fraction big number} \times \text{fraction small number}}$$

$$SD = \sqrt{\text{average of (entries)}^2 - (\text{average of entries})^2}$$

$$SD^+ = \sqrt{\frac{n}{n-1}} \times SD$$

Correlation coefficient

$$r = \text{average of } (SU_x \times SU_y)$$

r.m.s. error for the regression line of $y$ on $x$:

$$\sqrt{1-r^2} \times SD_y$$

Slope and Intercept of regression line:

$$m = r \times \frac{SD_y}{SD_x}, \qquad \text{and} \qquad b = avg_y - slope \times avg_x$$

Probability

| Rule | Expression |
|---|---|
| complement | $P(A^c) = 1 - P(A)$ |
| multiplication | $P(A \text{ and } B) = P(B\|A)P(A)$ |
| addition | $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ |
| independence | P(B\|A) = P(B) |

Binomial Formula

$$\frac{n!}{k!(n-k)!} p^k (1-p)^{n-k}$$

Sum of draws

- EV for sum = number of draws $\times$ (Average of box)
- SE for sum = $\sqrt{\text{number of draws}} \times$ (SD of box)

Percentage (typically of ticket 1)

- EV for % = (Average of box) $\times$ 100%
- SE for % = $\left(\text{SD of box}/\sqrt{\text{number of draws}}\right) \times 100\%$

Average of draws

- EV for avg = Average of box
- SE for avg = $\left(\text{SD of box}/\sqrt{\text{number of draws}}\right)$

Correction Factor

$$C.F. = \sqrt{\frac{N-n}{N-1}} \times SE$$

**Hypothesis test**

- State the Null hypothesis
- State the Alternative hypothesis
- Identify the type of test, and compute test statistic
- Calculate p-value (or determine percentile range for test statistic)
- Conclusion

One-sample z-test

$$z = \frac{Obs - Exp}{SE}$$

One-sample t-test

$$t = \frac{Obs - Exp}{SE}, \qquad \text{with} \quad df = n - 1, \quad \text{and} \quad SD^+$$

Two-sample z-test

$$z = \frac{Obs_{diff} - Exp_{diff}}{SE_{diff}} \qquad \text{with} \qquad SE_{diff} = \sqrt{SE_1^2 + SE_2^2}$$