

AP Statistics Formula Sheet

Key formulas for descriptive stats, probability, distributions, and inference. Essential for AP exam success.

Descriptive Statistics

Mean: $\bar{x} = (\text{sum of } x_i) / n$

Median: Middle value when data is ordered

Range: Max - Min

IQR: $Q_3 - Q_1$

Outlier test: $< Q_1 - 1.5(IQR)$ or $> Q_3 + 1.5(IQR)$

Variance: $s^2 = \text{sum}(x_i - \bar{x})^2 / (n - 1)$

Std Dev: $s = [\text{sum}(x_i - \bar{x})^2 / (n - 1)]^{1/2}$

z-score: $z = (x - \text{mean}) / \text{std dev}$

Probability Rules

Complement: $P(A') = 1 - P(A)$

Addition: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

Mutually excl: $P(A \text{ or } B) = P(A) + P(B)$

Multiplication: $P(A \text{ and } B) = P(A) * P(B|A)$

Independent: $P(A \text{ and } B) = P(A) * P(B)$

Conditional: $P(A|B) = P(A \text{ and } B) / P(B)$

Bayes: $P(A|B) = P(B|A) * P(A) / P(B)$

Linear Regression

Equation: $\hat{y} = a + bx$

Slope: $b = r(s_y / s_x)$

Intercept: $a = \bar{y} - b(\bar{x})$

r: Correlation coefficient (-1 to 1)

r²: % of variation in y explained by x

Residual: $y - \hat{y}$ (observed - predicted)

Random Variables

Expected value: $E(X) = \text{sum of } x_i * P(x_i)$

Variance: $\text{Var}(X) = \text{sum of } (x_i - E(X))^2 * P(x_i)$

SD: $\text{SD}(X) = \sqrt{\text{Var}(X)}$

Linear transform: $E(aX + b) = aE(X) + b$

Var transform: $\text{Var}(aX + b) = a^2\text{Var}(X)$

Sum of indep: $\text{Var}(X + Y) = \text{Var}(X) + \text{Var}(Y)$

Distributions

Binomial: $P(X=k) = C(n,k) p^k(1-p)^{(n-k)}$

Binomial mean: np

Binomial SD: $(np(1-p))^{1/2}$

Normal: $N(\text{mean}, \text{SD})$, use z-table

Empirical rule: 68-95-99.7 within 1-2-3 SD

Confidence Intervals

General form: $\text{statistic} \pm (\text{critical value})(\text{SE})$

1-prop z: $\hat{p} \pm z^* (\hat{p}(1-\hat{p})/n)^{1/2}$

1-sample t: $\bar{x} \pm t^* (s/n)^{1/2}$

2-prop z: $(p_1 - p_2) \pm z^* \text{SE}$

2-sample t: $(x_1 - x_2) \pm t^* \text{SE}$

Common z*: 90%: 1.645, 95%: 1.96, 99%: 2.576

Sampling Distributions

Mean of \bar{x} -bar: equal to population mean

SD of \bar{x} -bar: $\sigma / n^{1/2}$

Mean of \hat{p} -hat: equal to p

SD of \hat{p} -hat: $(p(1-p) / n)^{1/2}$

CLT: \bar{x} -bar is approx normal for large n

Hypothesis Testing

Null (H₀): Parameter = hypothesized value

Alt (H_a): Parameter \neq , $<$, or $>$ value

Test stat: $(\text{statistic} - \text{parameter}) / \text{SE}$

p-value: $P(\text{result this extreme} \mid H_0 \text{ true})$

Decision: If p-value $<$ alpha, reject H₀

Chi-square: $\chi^2 = \text{sum } (O - E)^2 / E$

Always check conditions before running inference: random sample, independence (10% rule), and normality (large counts or CLT).