AP STATISTICS: TESTS OF SIGNIFICANCE

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(1-Sample) z Test — *STAT > TESTS > 1: Z-Test*

Use this test to compare $\bar{x}$ *with* μ *(if* σ *is known).*

The question must provide μ, σ, $\bar{x}$, *and* n *or data from which these values can be computed.*

z test statistic = $\dfrac{\bar{x}-\mu}{\sigma/\sqrt{n}}$

Confidence Interval (CI) = $\bar{x} \pm z^{*}(\sigma/\sqrt{n})$

Assumptions:

(1) SRS
(2) Normal distribution
(3) Independence

2-Sample z Test — *STAT > TESTS > 3: 2-SampZ-Test*

Use this test to compare $\bar{x}_1 - \bar{x}_2$ *with* $\mu_1 - \mu_2$.

The question must provide σ_1, σ_2, μ_1, μ_2, $\bar{x}_1$, $\bar{x}_2$, n_1, *and* n_2 *or data from which these values can be computed.*

z test statistic = $\dfrac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\dfrac{\sigma_1{}^2}{n_1}+\dfrac{\sigma_2{}^2}{n_2}}}$

CI = $\left[(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)\right] \pm z^{*}\sqrt{\dfrac{\sigma_1{}^2}{n_1}+\dfrac{\sigma_2{}^2}{n_2}}$

Assumptions:

(1) SRS
(2) n_1>5 and n_2>5
(3) Similar sample size and distribution

1-Proportion z Test — *STAT > TESTS > 5: 1-PropZTest*

Use this test to compare $\hat{p}$ *with* p.

The question must provide x, n, *and* p *or data from which these values can be computed. (Sometimes, you must assume a value for* p, *such as 0.5 when you flip a coin).*

z test statistic = $\dfrac{\hat{p}-p}{\sqrt{\dfrac{p(1-p)}{n}}}$

CI = $\hat{p} \pm z^{*}\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}}$

Assumptions:

(1) SRS
(2) Rules of thumb:
    a. $n \le 0.1N$
    b. $np \ge 10$ and $n(1-p) \ge 10$

2-Proportion z Test — *STAT > TESTS > 6: 2-PropZTest*

Use this test to compare $\hat{p}_1 - \hat{p}_2$ *with* $p_1 - p_2$.

The question must provide x_1, x_2, n_1, *and* n_2 *or data from which these values can be computed.*

$$\hat{p}_c = \frac{x_1 + x_2}{n_1 + n_2}$$

z test statistic = $\dfrac{\hat{p}_1-\hat{p}_2}{\sqrt{\hat{p}_c(1-\hat{p}_c)(\dfrac{1}{n_1}+\dfrac{1}{n_2})}}$

CI = $(\hat{p}_1-\hat{p}_2) \pm z^{*}\sqrt{\dfrac{\hat{p}_1(1-\hat{p}_1)}{n_1}+\dfrac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

Assumptions:

(1) SRS
(2) Rules of thumb:
    a. $n_1 \le 0.1N_1$ and $n_2 \le 0.1N_2$
    b. $n_1\hat{p}_1 \ge 10$ and $n_1(1-\hat{p}_1) \ge 10$
    c. $n_2\hat{p}_2 \ge 10$ and $n_2(1-\hat{p}_2) \ge 10$

(1-Sample) t Test **_STAT > TESTS > 2: T-Test_**

Use this test to compare $\bar{x}$ with μ (if σ is NOT known).

The question usually provides a set of data from which you must compute $\bar{x}$ and n.

t test statistic = $\dfrac{\bar{x}-\mu}{s/\sqrt{n}}$

CI = $\bar{x} \pm t^{*}(s/\sqrt{n})$

Degrees of freedom (df) = $n-1$

Assumptions:

(1) SRS

(2) How large is n?

a. $n < 15$ (No outliers and no skewing)

b. $15 \le n \le 30$ (No large outliers and no strong skewing)

c. $n > 30$ (Good to go)

X^2 Test **_STAT > TESTS > C: X^2-Test_**

Use this test to compare observed values with expected values.

The question usually involves an r x c table. (If the totals are missing, then you must compute them yourself).

X^2 test statistic = $\sum \dfrac{(O-E)^2}{E}$

E = (row total x column total) / table total

Assumptions:

(1) SRS

(2) All expected counts > 1

< 20% of the expected counts can be < 5

2-Sample t Test **_STAT > TESTS > 4: 2-SampTTest_**

Use this test to decide if the difference between two samples (which represent two populations) is statistically significant.

The question must provide $\bar{x}_1$, $\bar{x}_2$, n_1, and n_2 or data from which these values can be computed.

t test statistic = $\dfrac{(\bar{x}_1-\bar{x}_2)}{\sqrt{\dfrac{s_1{}^2}{n_1}+\dfrac{s_2{}^2}{n_2}}}$

CI = $(\bar{x}_1-\bar{x}_2) \pm t^{*}\sqrt{\dfrac{s_1{}^2}{n_1}+\dfrac{s_2{}^2}{n_2}}$

df (conservative estimate) = (smaller n) – 1

*A more accurate df can be obtained using **2-SampTTest**.*

Assumptions:

(1) SRS

(2) n_1>5 and n_2>5

Similar sample size and distribution

MISCELLANEOUS INFORMATION

Normal distribution notation: $N(\mu, \sigma/\sqrt{n})$

Binomial distribution notation: $B(n, p)$

Empirical rule (normal distributions):

$\mu \pm \sigma$	~ 68% of data
$\mu \pm 2\sigma$	~ 95% of data
$\mu \pm 3\sigma$	~ 99.7% of data

Binomial check: NITC (fixed # of trials, independent, two, constant probability)

Binomial $\mu = np$ Binomial $\sigma = \sqrt{np(1-p)}$

z^* for 90% CI (α = 0.10) = 1.644853626

z^* for 95% CI (α = 0.05) = 1.959963986

z^* for 99% CI (α = 0.01) = 2.575829303

Note that whereas z^* remains constant as $n \to \infty$, t^* decreases due to the increased degrees of freedom.

Standard error (SE) = denominator of test stat formula OR the part of the CI formula after the critical value

Margin of error = second part of CI formula (after ±)