

Two Sample Hypothesis Tests for Proportions

$$H_0 : p_1 = p_2 \quad \text{or} \quad p_1 - p_2 = 0$$

Note #3: H_0 ALWAYS gets an = ...even if the wording in the problem sounds like it shouldn't

Note #1: Use colons

$$H_a : p_1 \neq p_2 \quad \text{or} \quad p_1 - p_2 \neq 0$$
$$H_a : p_1 < p_2 \quad \text{or} \quad p_1 - p_2 < 0$$
$$H_a : p_1 > p_2 \quad \text{or} \quad p_1 - p_2 > 0$$

Note #2: Use only PARAMETERS in your hypothesis...although there will be some problems where we'll use words/sentences

Note #4: The symbol used in the alternate will come from the context of the problem

\neq - two-sided test, equivalent to a Confidence Interval (CI)

$\{ \begin{matrix} < \\ > \end{matrix} \}$ - one-sided test

Steps in Hypothesis Testing

1. Define the population characteristic (i.e. parameter) about which hypotheses are to be tested.
2. State the null hypothesis H_0 .
3. State the alternative hypothesis H_a .
4. State the significance level for the test α .
5. Check all assumptions and state name of test.
6. State the name of the test.
7. State df if applicable (not applicable in proportion land).
8. Display the test statistic to be used without any computation at this point.
9. Compute the value of the test statistic, showing specific numbers used.
10. Calculate the P – value.
11. Sketch a picture of the situation.
12. State the conclusion in two sentences -
 1. Summarize in theory discussing H_0 .
 2. Summarize in context discussing H_a .

Two Sample Hypothesis Tests for Proportions

Steps in Two Sample Proportion Hypothesis Testing

1. $p_1 = \dots$
 $p_2 = \dots$

2. $H_0 : p_1 = p_2$
 \neq

3. $H_a : p_1 < p_2$
 $>$

4. State α .

5. Assumptions:

1. Random Independent Samples

2. $n_1 \hat{p}_1 \geq 10, n_1(1 - \hat{p}_1) \geq 10$
 $n_2 \hat{p}_2 \geq 10, n_2(1 - \hat{p}_2) \geq 10$

3. SSSTRP

6. 2 Sample Proportion z Test

7. $df = N/A$

only use \hat{p}_c
on Hypothesis Tests,
not on CIs

8/9.
$$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\hat{p}_c(1 - \hat{p}_c)}{n_1} + \frac{\hat{p}_c(1 - \hat{p}_c)}{n_2}}} = \#$$

$$\hat{p}_c = \frac{\text{total number of successes}}{\text{total number of trials}}$$

10. P -value =

$$P(z > \#) = \text{normalcdf}(\#, 1E99, 0, 1)$$

$$P(z < \#) = \text{normalcdf}(-1E99, \#, 0, 1)$$

$$2P(z > \#) = 2 * \text{normalcdf}(\#, 1E99, 0, 1)$$

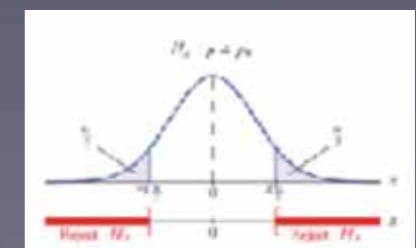
$$2P(z < \#) = 2 * \text{normalcdf}(-1E99, \#, 0, 1)$$

12. State the conclusion in two sentences -
1. Summarize in theory discussing H_0 .
 2. Summarize in context discussing H_a .



} one-sided tests

} two-sided tests



Confidence Intervals

General CI Formula

Statistic \pm (Critical Value)(Standard Deviation)

2 Sample Proportion z CI Formula

$$(\hat{p}_1 - \hat{p}_2) \pm z \sqrt{\frac{\hat{p}_1(1 - \hat{p}_1)}{n_1} + \frac{\hat{p}_2(1 - \hat{p}_2)}{n_2}}$$

Use Table or Calculator to get the z critical value




TABLE B: z-DISTRIBUTION CRITICAL VALUES

df	Tail probability p											
	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.278	1.395	1.518	1.645	1.771	1.897	2.054	2.170	2.282	2.330	2.398
2	.816	1.062	1.286	1.518	1.645	1.771	1.897	2.054	2.170	2.282	2.330	2.398
3	.765	.978	1.250	1.478	1.605	1.731	1.857	2.014	2.130	2.242	2.290	2.358
4	.741	.941	1.210	1.438	1.565	1.691	1.817	1.974	2.090	2.202	2.250	2.318
5	.727	.920	1.196	1.424	1.551	1.677	1.803	1.960	2.076	2.188	2.236	2.304
6	.718	.906	1.184	1.410	1.537	1.663	1.789	1.946	2.062	2.174	2.222	2.290
7	.711	.896	1.179	1.405	1.532	1.658	1.784	1.941	2.057	2.169	2.217	2.285
8	.706	.889	1.176	1.397	1.524	1.650	1.776	1.933	2.049	2.161	2.209	2.277
9	.702	.885	1.173	1.393	1.520	1.646	1.772	1.929	2.045	2.157	2.205	2.273
10	.700	.883	1.172	1.392	1.519	1.645	1.771	1.928	2.044	2.156	2.204	2.272
11	.698	.882	1.171	1.391	1.518	1.644	1.770	1.927	2.043	2.155	2.203	2.271
12	.697	.881	1.171	1.391	1.518	1.644	1.770	1.927	2.043	2.155	2.203	2.271
13	.696	.881	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
14	.695	.880	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
15	.695	.880	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
16	.694	.879	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
17	.694	.879	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
18	.693	.879	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
19	.693	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
20	.693	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
21	.692	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
22	.692	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
23	.692	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
24	.692	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
25	.692	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
26	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
27	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
28	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
29	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
30	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
31	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
32	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
33	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
34	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
35	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
36	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
37	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
38	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
39	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
40	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
41	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
42	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
43	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
44	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
45	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
46	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
47	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
48	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
49	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270
50	.691	.878	1.170	1.390	1.517	1.643	1.769	1.926	2.042	2.154	2.202	2.270



Interpretation for Two Sample Proportion Confidence Intervals

We are ___% confident that $p_1 - p_2$, the true difference in proportions of _____, is between ___ and ___.

Interpretation for the Confidence Level of Two Sample Proportion Confidence Intervals

We used a method to construct this estimate that in the long run will successfully capture the true value of $p_1 - p_2$ ___% of the time.

ALWAYS check your assumptions and interpret your interval, even you are not specifically asked to in the problem. Just do it. Seriously.

General Work Flow -

1. Assumptions
2. Construction of Interval
3. Interpretation(s)