Critical numbers for Hypothesis Tests

NEGATIVE z Scores

Table A-2 Standard Normal (z) Distribution: Cumulative Area from the LEFT

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	..0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
.	.	.	.	.	.	.	.	.	.	.

Performing a Hypothesis Test for a population mean when σ is known:

The Standard Normal Distribution is used to test a hypothesis about a population mean when two conditions are met. First, the sample size must be large, $n > 30$, or the population distribution must be normal. Second, there must be an acceptable estimate for the standard deviation (**σ**) of the population.

Performing a Hypothesis Test for a population proportion:

Samples are used to test a hypothesis about the proportion of a population that possess one particular criteria. A sample is taken and the number of objects which meet the criteria are recorded. When $np > 5$ and $nq > 5$ where n is the size of the sample, p is the proportion of the population which meet the criteria and q is the proportion of the population which do not meet the criteria, the result is a Standard Normal Distribution. By dividing the resulting distribution by the number in the sample, the result is a Standard Normal Distribution that reflects the proportion of the samples which meet the criteria. Thus the Standard Normal Distribution is used to test a hypothesis about a population proportion.

Finding Critical Numbers using the Standard Normal Distribution:

To find a critical number for a hypothesis test, first determine whether it is a left tail, right tail or two tail test. This is determined by examining the claim. Then find α or $\alpha/2$ on the NEGATIVE side of the Standard Normal Distribution Table. Lastly decide on the sign of the critical number.

If the claim is < or $\geq$, then the problem is a left tail test. Left tail tests DO NOT divide α by two. Look up α on the NEGATIVE side of the Standard Normal Distribution Table. The final critical number will be negative.

If the claim is > or $\leq$, then the problem is a right tail test. Right tail tests DO NOT divide α by two. Look up α on the NEGATIVE side of the Standard Normal Distribution Table. Alternatively looking up $1 - \alpha$ on the POSITIVE side of the Standard Normal Distribution Table will produce a z score with the same absolute value but it is positive. The final critical number will be positive.

If the claim is = or $\neq$, then the problem is a two tail test. Two tail tests divide α by two. Look up $\alpha/2$ on the NEGATIVE side of the Standard Normal Distribution Table. Alternatively looking up $1 - \alpha/2$ on the

POSITIVE side of the Standard Normal Distribution Table will produce a z score with the same absolute value but it is positive. Two tail tests have two critical numbers, one positive and one negative.

Example 1: Find the critical number or numbers for a claim of p = 0.35 and α = .03. Since the claim is p = 0.35, this is a two tail test. Taking α and dividing by 2 yields .015. Looking at the row on the NEGATIVE side of the Standard Normal Distribution Table labeled – 2.1, .0150 is in the column that corresponds to .07. So the z-score is – (2.1 + .07) = – 2.17. This is a two tail test so the critical numbers are ± 2.17 .

Example 2: Find the critical number or numbers for a claim of $\mu < 2.31$ and α = .03. Since the claim is μ < 2.31, this is a left tail test. Looking at the row on the NEGATIVE side of the Standard Normal Distribution Table labeled – 1.8, .0301 is in the column that corresponds to .08 and .0294 is in the column that corresponds to .09. Since .0301 is closest to .0300 the z-score is – (1.8 + .08) = – 1.88. This is a left tail test so the critical number is – 1.88.

Example 3: Find the critical number or numbers for a claim of p > 0.20 and α = .01. Since the claim is p > 0.20, this is a right tail test. Looking at the row on the NEGATIVE side of the Standard Normal Distribution Table labeled – 2.3, .0102 is in the column that corresponds to .02 and .0099 is in the column that corresponds to .03. Since .0099 is closest to .0100 the z-score is – (2.3 + .03) = – 2.33. This is a right tail test so the critical number is + 2.33.

Practice Problems: Find the Critical Number or Numbers for each of the following claims and significance levels. For each problem involving a population mean, assume that the sample size is greater than 30 and that a reasonable approximation of σ is given.

1.) Claim: p > .5, α = .03

2.) Claim: μ < 324.6, α = .04

3.) Claim: $\mu \neq$ 15.4, α = .04

4.) Claim: p < .65, α = .01

5.) Claim: p =.40, α = .05

6.) Claim: $\mu >$ 157.8, α = .02

7.) Claim: $\mu \geq$ 76.2, α = .03

8.) Claim: p $\leq$ 0.29, α = .01

Solutions:

1.) 1.88	2.) – 1.75	3.) $\pm$ 2.05	4.) – 2.33
5.) $\pm$ 1.96	6.) 2.05	7.) – 1.88	8.) 2.33