LMR_Spring 2020

# Midterm Formulas & Cheat Sheet

**Mean:**
Sum of all observations
Sample size

**Mode:**
Most frequent response

**Median:**
Mid-point (50%)

**Range:**
Maximum # - Minimum # + 1=

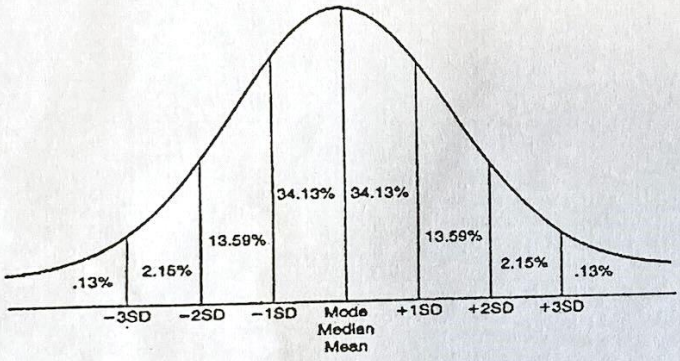
**Interquartile Range:**
75% # - 25% #

**Z score:**

$$z = \frac{X - \bar{X}}{s}$$

$$z = \frac{\text{Raw Score} - \text{Mean Score}}{\text{Standard Deviation}}$$

**Normal Curve**




**Central Limit Theorem and Sampling Distributions**

An infinite # of samples creates a Sampling Distribution
- Even skewed samples approach or become normal curves if sample size is large
- The mean of the sampling distribution = the population mean
- Standard Deviation of the sample used to calculate Standard Error for the population

**Confidence Intervals for the Mean of the Population**

*95% Confidence Interval*
Low Pt: Mean - [1.96 x Standard Error] High Pt: Mean + [1.96 x Standard Error]

*99% Confidence Interval*
Low Pt: Mean - [2.58 x Standard Error] High Pt: Mean + [2.58 x Standard Error]

**Hypothesis Testing** - (Can we reject chance as the reason for the relationship?)

Differences due to Chance = The Null Hypothesis (Can we reject the null?)

$H_0$ = There is NO relationship or the relationship is just due to chance.

$H_{R2}$ (2 tailed) = There is a relationship that is unlikely to be due to chance, but do not know the direction. Rejection region is divided between the tails.

$H_{R1}$ (1 tailed) = There is a positive relationship. OR There is a negative relationship. Rejection region is ALL in one tail. Relationship is unlikely to be due to chance.

If you have a 1-tailed test, the direction of the relationship IS important for determining statistical significance. You could be in the wrong tail and the research hypothesis will **NOT** be supported.

P-value for test statistic must be **smaller** than these three conventions to say a relationship is statistically significant: (If **below** these p-values, it is unlikely the relationship is due to chance.)

* p-value less than or equal to 5% ($p <= 0.05$)

** p-value less than or equal to 1% ($p <= 0.01$)

*** p-value less than or equal to 0.1% ($p <= 0.001$)

**Z score statistic for comparing two mean values**

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{\text{Group SD}}$$

Z-score test statistic must be **larger** than the critical value (CV) to be statistically significant:

CV = 1.65 for a 1-tailed test, 0.05 rejection region

CV = 1.96 for a 2-tailed test, 0.05 rejection region

CV = 2.33 for a 1-tailed test, 0.01 rejection region

CV = 2.58 for a 2-tailed test, 0.01 rejection region

**Type I Error** (Chance may still be the reason for the relationship!)

You have rejected the null, but there is **NOT** really a relationship in the population.

With a 0.05 rejection region, there is a 5% probability the relationship **IS** due to chance.

**Type II Error**

You accepted the null, but there **IS** a relationship in the population.

**Chi-Square statistic for nominal scale variables**

To determine *direction of relationship*, look at Yes-Yes (1, 1) or cell d quadrant

If Count (observed value) is **larger** than the Expected Count = positive relationship

If Count (observed value) is **smaller** than the Expected Count = negative relationship

To determine *statistical significance* of the chi-square statistic

Compare chi-square test statistic to critical value.

Critical value is 3.84 for .05 two-tailed test with 1 df

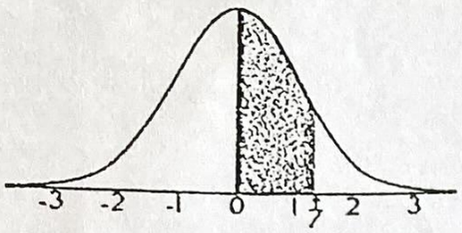
Critical value is 2.71 for .05 one-tailed test with 1 df

$Chi^2$ value must be **larger** than the critical value

Compare p-value of $chi^2$ to levels of statistical significance

P-value from SPSS must be **smaller** than desired level of sign (0.05, 0.01, 0.001 for 2-tail)

For one tailed test, divide p-value shown on SPSS by 2




## STANDARD NORMAL TABLE (z)

Entries in the table give the area under the curve between the mean and $z$ standard deviations above the mean. For example, for $z = 1.25$ the area under the curve between the mean (0) and $z$ is 0.3944.



**TABLE 4.3 Areas of the Normal Curve**

| | Area Under the Normal Curve between Mean and z Score | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
| 0.0 | 00.00 | 00.40 | 00.80 | 01.20 | 01.60 | 01.99 | 02.39 | 02.79 | 03.19 | 03.59 |
| 0.1 | 03.98 | 04.38 | 04.78 | 05.17 | 05.57 | 05.96 | 06.36 | 06.75 | 07.14 | 07.53 |
| 0.2 | 07.93 | 08.32 | 08.71 | 09.10 | 09.48 | 09.87 | 10.26 | 10.64 | 11.03 | 11.41 |
| 0.3 | 11.79 | 12.17 | 12.55 | 12.93 | 13.31 | 13.68 | 14.06 | 14.43 | 14.80 | 15.17 |
| 0.4 | 15.54 | 15.91 | 16.28 | 16.64 | 17.00 | 17.36 | 17.72 | 18.08 | 18.44 | 18.79 |
| 0.5 | 19.15 | 19.50 | 19.85 | 20.19 | 20.54 | 20.88 | 21.23 | 21.57 | 21.90 | 22.24 |
| 0.6 | 22.57 | 22.91 | 23.24 | 23.57 | 23.89 | 24.22 | 24.54 | 24.86 | 25.17 | 25.49 |
| 0.7 | 25.80 | 26.11 | 26.42 | 26.73 | 27.04 | 27.34 | 27.64 | 27.94 | 28.23 | 28.52 |
| 0.8 | 28.81 | 29.10 | 29.39 | 29.67 | 29.95 | 30.23 | 30.51 | 30.78 | 31.06 | 31.33 |
| 0.9 | 31.59 | 31.86 | 32.12 | 32.38 | 32.64 | 32.90 | 33.15 | 33.40 | 33.65 | 33.89 |
| 1.0 | 34.13 | 34.38 | 34.61 | 34.85 | 35.08 | 35.31 | 35.54 | 35.77 | 35.99 | 36.21 |
| 1.1 | 36.43 | 36.65 | 36.86 | 37.08 | 37.29 | 37.49 | 37.70 | 37.90 | 38.10 | 38.30 |
| 1.2 | 38.49 | 38.69 | 38.88 | 39.07 | 39.25 | 39.44 | 39.62 | 39.80 | 39.97 | 40.15 |
| 1.3 | 40.32 | 40.49 | 40.66 | 40.82 | 40.99 | 41.15 | 41.31 | 41.47 | 41.62 | 41.77 |
| 1.4 | 41.92 | 42.07 | 42.22 | 42.36 | 42.51 | 42.65 | 42.79 | 42.92 | 43.06 | 43.19 |
| 1.5 | 43.32 | 43.45 | 43.57 | 43.70 | 43.83 | 43.94 | 44.06 | 44.18 | 44.29 | 44.41 |
| 1.6 | 44.52 | 44.63 | 44.74 | 44.84 | 44.95 | 45.05 | 45.15 | 45.25 | 45.35 | 45.45 |
| 1.7 | 45.54 | 45.64 | 45.73 | 45.82 | 45.91 | 45.99 | 46.08 | 46.16 | 46.25 | 46.33 |
| 1.8 | 46.41 | 46.49 | 46.56 | 46.64 | 46.71 | 46.78 | 46.86 | 46.93 | 46.99 | 47.06 |
| 1.9 | 47.13 | 47.19 | 47.26 | 47.32 | 47.38 | 47.44 | 47.50 | 47.56 | 47.61 | 47.67 |
| 2.0 | 47.72 | 47.78 | 47.83 | 47.88 | 47.93 | 47.98 | 48.03 | 48.08 | 48.12 | 48.17 |
| 2.1 | 48.21 | 48.26 | 48.30 | 48.34 | 48.38 | 48.42 | 48.46 | 48.50 | 48.54 | 48.57 |
| 2.2 | 48.61 | 48.64 | 48.68 | 48.71 | 48.75 | 48.78 | 48.81 | 48.84 | 48.87 | 48.90 |
| 2.3 | 48.93 | 48.96 | 48.98 | 49.01 | 49.04 | 49.06 | 49.09 | 49.11 | 49.13 | 49.16 |
| 2.4 | 49.18 | 49.20 | 49.22 | 49.25 | 49.27 | 49.29 | 49.31 | 49.32 | 49.34 | 49.36 |
| 2.5 | 49.38 | 49.40 | 49.41 | 49.43 | 49.45 | 49.46 | 49.48 | 49.49 | 49.51 | 49.52 |
| 2.6 | 49.53 | 49.55 | 49.56 | 49.57 | 49.59 | 49.60 | 49.61 | 49.62 | 49.63 | 49.64 |
| 2.7 | 49.65 | 49.66 | 49.67 | 49.68 | 49.69 | 49.70 | 49.71 | 49.72 | 49.73 | 49.74 |
| 2.8 | 49.74 | 49.75 | 49.76 | 49.77 | 49.77 | 49.78 | 49.79 | 49.79 | 49.80 | 49.81 |
| 2.9 | 49.81 | 49.82 | 49.82 | 49.83 | 49.84 | 49.84 | 49.85 | 49.85 | 49.86 | 49.86 |
| 3.0 | 49.87 | | | | | | | | | |
| 3.5 | 49.98 | | | | | | | | | |
| 4.0 | 49.997 | | | | | | | | | |
| 5.0 | 49.99997 | | | | | | | | | |

*Source:* The original data for Table 4.3 came from *Tables for Statisticians and Biometricians*, edited by K. Pearson, published by the Imperial College of Science and Technology, and are used here by permission of the Biometrika trustees. The adaptation of these data is taken from E. L. Lindquist, *A First Course in Statistics* (revised edition), with permission of the publisher, Houghton Mifflin Company.