(8)

Standard error of the mean

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \text{standard error of the mean}$$

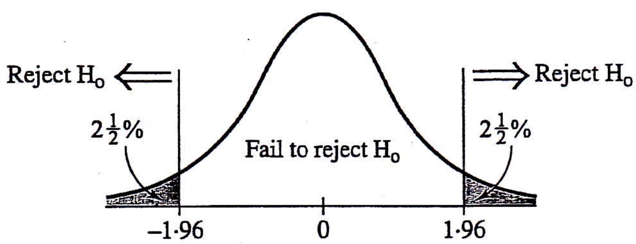
The standard deviation of the sample means is called the standard error and is denoted by $\frac{\sigma}{\sqrt{n}}$.

The standard error is precisely that. It is the standard distance, or error, that a sample mean is from the population mean. On our course, we want to know how good an estimate the sample mean is from the population mean. The standard error gives us just that. The standard error is also a standard deviation.

Note: As the sample size, n, gets larger, the standard error gets smaller. In other words, the approximation gets better and better with increasing sample size.

The distribution of the sample means is normal. Thus, we can use the Standard Normal Tables to calculate the probability that the mean of a sample of a certain size differs from the mean of the population by a given amount. Later on we will see how the distribution of the sample means is extremely useful to hypothesis testing when we consider a sample from a population rather than a single value.

Testing the null hypothesis using *z*-values



At the 5% level of significance for a two-tailed test:

$$-1{\cdot}96 \leq z \leq 1{\cdot}96$$

If the value of z lies outside the range $-1{\cdot}96 \leq z \leq 1{\cdot}96$, we reject H_0. The area outside the range is called the critical region (the shaded regions in the diagram above).

For z-values, the steps involved in hypothesis testing are:

1. Write down the null hypothesis, H_0, and the alternative hypothesis, H_A.
2. Convert the observed results into z units. (This is sometimes referred to as the test statistic.)
3. Reject H_0 if z is outside the range $-1{\cdot}96 \leq z \leq 1{\cdot}96$. Otherwise, we fail to reject H_0. (A diagram will help.)
4. State the conclusion in words.