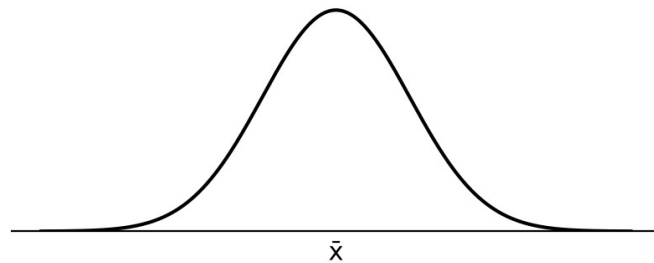


8B Finding Type I and Type II Errors Using the Normal Distribution

Distribution of the sample mean $\bar{X}$ for a sample of size n from $N(\mu, \sigma^2)$:

P(Type I error) when a continuous distribution is used:

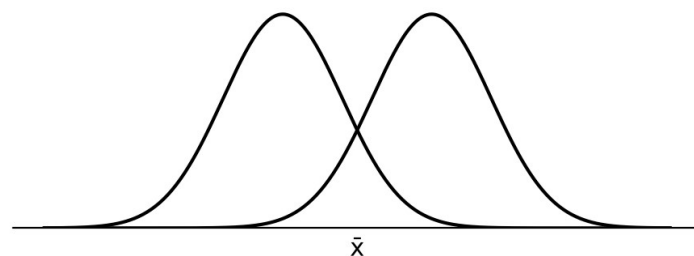
1. Bags of sugar having a nominal weight of 1 kg are filled by a machine. From past experience it is known that the weight, X kg, of sugar in the bags is normally distributed with a standard deviation of 0.04 kg. At the beginning of each week a random sample of 10 bags is taken in order to see if the machine needs to be reset. A test is then done at the 5% significance level with $H_0: \mu = 1.00$ kg and $H_1: \mu \neq 1.00$ kg. Find:
 - a) the critical region for this test



- b) P(Type I error) for this test.

Assuming that the mean weight has in fact changed to 1.02 kg,

- c) find P(Type II error) for this test.



2. The weight of jam in a jar, measured in grams, is distributed normally with a mean of 150 g and a standard deviation of 6 g. The production process occasionally leads to a change in the mean weight of jam per jar but the standard deviation remains unaltered.

The manager monitors the production process and for every new batch takes a random sample of 25 jars and weighs their contents to see if there has been any reduction in the mean weight of jam per jar.

Find the critical values for the test statistic $\bar{X}$, the mean weight of jam in a sample of 25 jars, using:

a) a 5% level of significance

b) a 1% level of significance.

Given that the true value of μ for the new batch is in fact 147,

c) find the probability of a Type II error for each of the above critical regions.

Relationship between P(Type I error) and P(Type II error):

How to reduce both P(Type I error) and P(Type II error):