**Power & Sample Size**

1. In a 2-sample t-test, average time is 15 days with a standard deviation, s = 2 days.

   The sample size must be large enough to provide a 95% chance of detecting a difference (if it exists) in the average times, as small as 3 days. Using an alpha risk of 0.05, what sample size would you recommend?

## Power and Sample Size

2-Sample t Test
Testing mean 1 = mean 2 (versus ≠)
Calculating power for mean 1 = mean 2 + difference
α = 0.05  Assumed standard deviation = 2

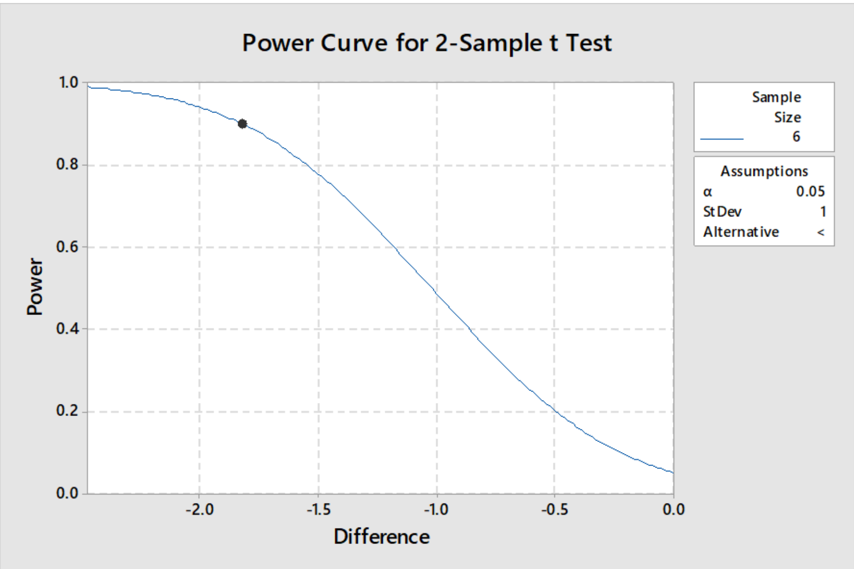
### Results

| Difference | Sample Size | Target Power | Actual Power |
|---|---|---|---|
| 3 | 9 | 0.8 | 0.847610 |

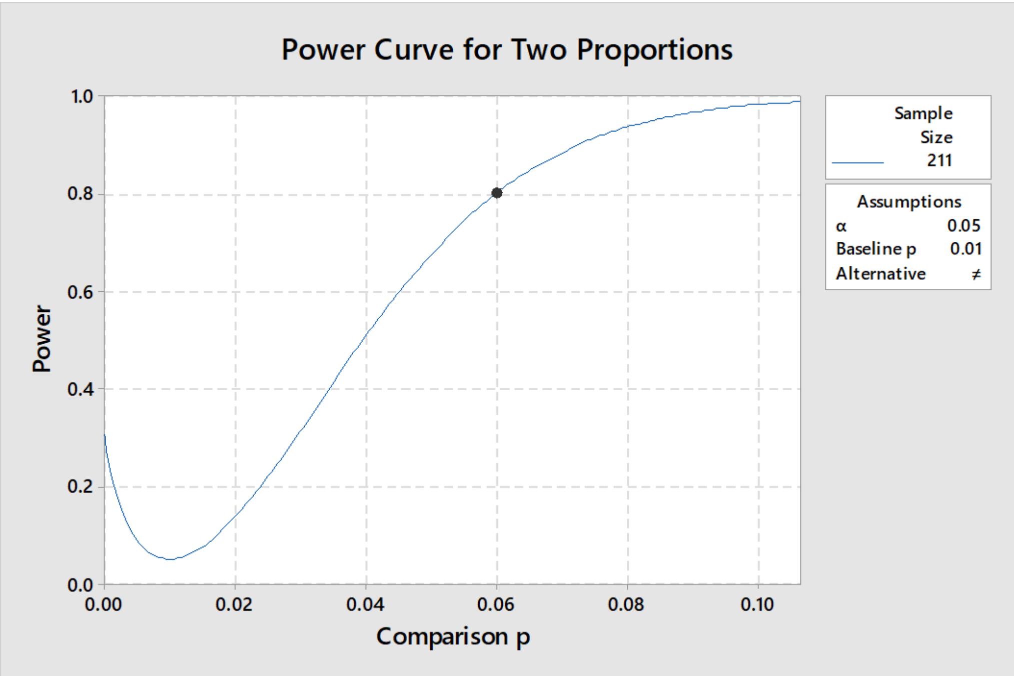
*The sample size is for each group.*

### Power Curve for 2-Sample t Test

2. In a destructive testing process, management has decided that only 6 samples can be used. If α = 0.05, and β = 0.1. What is the smallest difference we can reliably detect in a one-sided test where SD is equal to 1?



3. In testing stage has 6% defective. The process was improved and now the improvement team claims that there is only 1% defective. How many samples must the team examine to reliably detect this improvement?




4. In a 1-sample t-test which consists of a very expensive destructive testing, only 3 samples were collected. Sigma was found to be 0.4. So the team decided that their tested should be able to detect a true difference of at least 1 sigma. Considering that it is an important safety test, decide suitable alpha.
   a. What is the power of this test? Is it sufficient?

   **Inference**: Alpha taken to be 1% and so power is very low and not sufficient.

## Power and Sample Size

1-Sample t Test
Testing mean = null (versus ≠ null)
Calculating power for mean = null + difference
α = 0.01  Assumed standard deviation = 0.4

### Results

| Difference | Sample Size | Power |
|---|---|---|
| 0.4 | 3 | 0.0391148 |

### Power Curve for 1-Sample t Test

b. How many more samples are needed if the power should be kept at 0.8?

**Inference:** Sample Size requirement drastically increases

## Power and Sample Size

1-Sample t Test
Testing mean = null (versus ≠ null)
Calculating power for mean = null + difference
α = 0.01 Assumed standard deviation = 0.4

### Results

| Difference | Sample Size | Target Power | Actual Power |
|---|---|---|---|
| 0.4 | 16 | 0.8 | 0.834590 |

### Power Curve for 1-Sample t Test

c. If more samples cannot be collected, then as a BB, how will you conclude the results of the test

**Inference**: By keeping the sample size at 3 and power at .8, a difference of 2.9 can be detected by the team instead of 0.4. That is a first level compromise solution.

## Power and Sample Size

1-Sample t Test
Testing mean = null (versus ≠ null)
Calculating power for mean = null + difference
α = 0.01 Assumed standard deviation = 0.4

### Results

| Sample Size | Power | Difference |
|---|---|---|
| 3 | 0.8 | 2.92796 |

### Power Curve for 1-Sample t Test

**Inference II:** Next level compromise solution will be be make the test 1 sided, this will further increase the difference.

# Power and Sample Size

1-Sample t Test
Testing mean = null (versus < null)
Calculating power for mean = null + difference
$\alpha$ = 0.01  Assumed standard deviation = 0.4

## Results

| Sample Size | Power | Difference |
|---|---|---|
| 3 | 0.8 | -2.06900 |

### Power Curve for 1-Sample t Test