# Ninja Warrior - Part 1

**Approximately many times would you say the 'Salmon Ladder' was used?**

```
[1] n (control) = 69

[1] n (truncated) = 70

[1] n (logarithmic) = 67
```

```
    control           truncated           logarithmic
 Min.   :40.00    Min.    :40.00    Min.    :9.000e+00
 1st Qu.:41.00    1st Qu.:41.00    1st Qu.:3.000e+01
 Median :41.00    Median :41.00    Median :3.500e+01
 Mean   :41.21    Mean    :41.35    Mean    :1.429e+13
 3rd Qu.:42.00    3rd Qu.:42.00    3rd Qu.:4.000e+01
 Max.   :45.00    Max.    :45.00    Max.    :1.000e+15
 Var    :0.752    Var     :0.753    Var     :1.49253726820573e+28
```

**Control Plot**

```
    Shapiro-Wilk normality test

data:  control
W = 0.80959, p-value = 5.114e-08
```

**Truncated Plot**

```
    Shapiro-Wilk normality test

data:  truncated
W = 0.82679, p-value = 1.327e-07
```

**Control Plot**

[1] Median: 41

[1] Number of observations below median: 12

[1] Number of observations above median: 21

[1] Number of observations at median: 36

## Truncated Plot

[1] Median: 41

[1] Number of observations below median: 9

[1] Number of observations above median: 28

[1] Number of observations at median: 33

## Two sided sign tests for the control plot responses

[1] *CONTROL*


    One-sample Sign-Test

data:  control
s = 3, p-value = 1.967e-11
alternative hypothesis: true median is not equal to 42
95 percent confidence interval:
 41 41
sample estimates:
median of x
       41


Achieved and Interpolated Confidence Intervals:

|  | Conf.Level | L.E.pt | U.E.pt |
|---|---|---|---|
| Lower Achieved CI | 0.9467 | 41 | 41 |
| Interpolated CI | 0.9500 | 41 | 41 |
| Upper Achieved CI | 0.9705 | 41 | 41 |

## Two sided sign tests for the truncated plot responses

[1] *TRUNCATED*


    One-sample Sign-Test

```
data:   truncated
s = 5, p-value = 1.285e-09
alternative hypothesis: true median is not equal to 42
95 percent confidence interval:
 41.00 41.25
sample estimates:
median of x
        41
```

```
Achieved and Interpolated Confidence Intervals:
```

|                   | Conf.Level | L.E.pt | U.E.pt |
|-------------------|-----------|--------|--------|
| Lower Achieved CI | 0.9278    | 41     | 41.25  |
| Interpolated CI   | 0.9500    | 41     | 41.25  |
| Upper Achieved CI | 0.9586    | 41     | 41.25  |

**One-sided sign tests for the control plot responses**

```
[1] *CONTROL*
```

```
    One-sample Sign-Test
```

```
data:   control
s = 3, p-value = 9.837e-12
alternative hypothesis: true median is less than 42
95 percent confidence interval:
 -Inf   41
sample estimates:
median of x
        41
```

```
Achieved and Interpolated Confidence Intervals:
```

|                   | Conf.Level | L.E.pt | U.E.pt |
|-------------------|-----------|--------|--------|
| Lower Achieved CI | 0.9260    | -Inf   | 41     |
| Interpolated CI   | 0.9500    | -Inf   | 41     |
| Upper Achieved CI | 0.9544    | -Inf   | 41     |

```
    One-sample Sign-Test
```

```
data:   control
s = 3, p-value = 1
```

4

alternative hypothesis: true median is greater than 42
95 percent confidence interval:
  41 Inf
sample estimates:
median of x
         41


Achieved and Interpolated Confidence Intervals:


                   Conf.Level L.E.pt U.E.pt
Lower Achieved CI     0.9260     41    Inf
Interpolated CI       0.9500     41    Inf
Upper Achieved CI     0.9544     41    Inf

**One-sided sign tests for the truncated plot responses**

[1] *TRUNCATED*


    One-sample Sign-Test

data:  truncated
s = 5, p-value = 6.424e-10
alternative hypothesis: true median is less than 42
95 percent confidence interval:
     -Inf 41.10349
sample estimates:
median of x
         41


Achieved and Interpolated Confidence Intervals:


                   Conf.Level L.E.pt  U.E.pt
Lower Achieved CI     0.9402   -Inf 41.0000
Interpolated CI       0.9500   -Inf 41.1035
Upper Achieved CI     0.9639   -Inf 41.2500


    One-sample Sign-Test

data:  truncated
s = 5, p-value = 1
alternative hypothesis: true median is greater than 42
95 percent confidence interval:
  41 Inf

```
sample estimates:
median of x
        41


Achieved and Interpolated Confidence Intervals:

               Conf.Level L.E.pt U.E.pt
Lower Achieved CI     0.9402     41    Inf
Interpolated CI       0.9500     41    Inf
Upper Achieved CI     0.9639     41    Inf

[1] *CONTROL*


    One Sample t-test

data:  means
t = -93.8, df = 99, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 42
95 percent confidence interval:
 41.17979 41.21377
sample estimates:
mean of x
 41.19678

[1] *TRUNCATED*


    One Sample t-test

data:  means
t = -80.207, df = 99, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 42
95 percent confidence interval:
 41.34358 41.37527
sample estimates:
mean of x
 41.35943

[1] n =  65

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   9.00   30.00   35.00   67.07   40.00 1000.00

[1] Var = 28809.5599975962
```

## Summary statistics of the R versions

```
[1] n =  38
```

```
   r_control         r_truncated        r_logarithmic
 Min.   :40.00    Min.   :40.00    Min.   : 30.00
 1st Qu.:41.00    1st Qu.:41.00    1st Qu.: 35.00
 Median :41.00    Median :41.00    Median : 35.00
 Mean   :41.49    Mean   :41.57    Mean   : 39.74
 3rd Qu.:42.00    3rd Qu.:42.00    3rd Qu.: 40.00
 Max.   :43.00    Max.   :45.00    Max.   :120.00
```

## Summary statistics of the Python versions

```
[1] n (control) =  31
```

```
[1] n (truncated) =  31
```

```
[1] n (logarithmic) =  28
```

```
   py_control        py_truncated       py_logarithmic
 Min.   :40.00    Min.   :40.00    Min.   :9.000e+00
 1st Qu.:40.00    1st Qu.:41.00    1st Qu.:1.200e+01
 Median :41.00    Median :41.00    Median :1.500e+01
 Mean   :40.87    Mean   :41.10    Mean   :3.226e+13
 3rd Qu.:41.00    3rd Qu.:41.25    3rd Qu.:4.800e+01
 Max.   :45.00    Max.   :44.00    Max.   :1.000e+15
```

## Approximately how much more than 'Log Grip' would you say 'Salmon Ladder' was was used?

```
[1] n (control) =  70
```

```
[1] n (truncated) =  70
```

```
[1] n (logarithmic) =  70
```

```
    control           truncated          logarithmic
 Min.   :3.000    Min.   :1.000    Min.   :1.000
 1st Qu.:4.250    1st Qu.:5.000    1st Qu.:2.250
 Median :5.000    Median :6.000    Median :3.500
 Mean   :5.357    Mean   :5.871    Mean   :3.671
 3rd Qu.:6.000    3rd Qu.:7.000    3rd Qu.:5.000
 Max.   :7.000    Max.   :7.000    Max.   :7.000
 Var    :1.334    Var    :1.998    Var    :2.746
```

```
[1] n (control) =  38
```

```
[1] n (truncated) =  38

[1] n (logarithmic) =  38
```

```
   control_r      truncated_r     logarithmic_r
Min.   :3.0    Min.   :1.000    Min.   :1.000
1st Qu.:5.0    1st Qu.:5.000    1st Qu.:3.000
Median :6.0    Median :6.000    Median :5.000
Mean   :5.5    Mean   :5.895    Mean   :4.263
3rd Qu.:6.0    3rd Qu.:7.000    3rd Qu.:5.750
Max.   :7.0    Max.   :7.000    Max.   :7.000
Var    :1.284  Var    :1.772    Var    :2.523
```

```
[1] n (control) =  31

[1] n (truncated) =  31

[1] n (logarithmic) =  31
```

```
   control_py      truncated_py    logarithmic_py
Min.   :3.000   Min.   :1.000    Min.   :1.000
1st Qu.:4.000   1st Qu.:5.500    1st Qu.:2.000
Median :5.000   Median :6.000    Median :3.000
Mean   :5.129   Mean   :5.806    Mean   :2.968
3rd Qu.:6.000   3rd Qu.:7.000    3rd Qu.:4.000
Max.   :7.000   Max.   :7.000    Max.   :7.000
Var    :1.316   Var    :2.361    Var    :2.232
```

**Approximately how much more than 'Quintuple Steps' would you say 'Salmon Ladder' was used?**

```
    control        logarithmic       truncated
Min.   :1.000   Min.   :1.000    Min.   :2.000
1st Qu.:2.000   1st Qu.:1.000    1st Qu.:3.000
Median :3.000   Median :2.000    Median :4.000
Mean   :3.129   Mean   :2.229    Mean   :3.771
3rd Qu.:4.000   3rd Qu.:3.000    3rd Qu.:4.750
Max.   :7.000   Max.   :6.000    Max.   :7.000
```

## Ninja Warrior - Part 2

**How large would you say the difference between 'Jumping spider' and 'Salmon Ladder' is?**

```
[1] n (default) =  70

[1] n (narrower) =  70
```

```
[1] n (wider) =  70

     default             wider              narrower
 Min.   :4.000    Min.    :2.000    Min.    :3.000
 1st Qu.:5.000    1st Qu.:5.000    1st Qu.:6.000
 Median :6.000    Median :6.000    Median :6.000
 Mean   :5.914    Mean    :5.357    Mean    :6.129
 3rd Qu.:7.000    3rd Qu.:6.000    3rd Qu.:7.000
 Max.   :7.000    Max.    :7.000    Max.    :7.000
 Var    :0.775    Var     :1.363    Var     :0.867


[1] n (default) =  70

[1] n (narrower) =  67

[1] n (wider) =  64

     default             wider              narrower
 Min.   :4.000    Min.    :4.000    Min.    :5.000
 1st Qu.:5.000    1st Qu.:5.000    1st Qu.:6.000
 Median :6.000    Median :6.000    Median :6.000
 Mean   :5.914    Mean    :5.543    Mean    :6.257
 3rd Qu.:7.000    3rd Qu.:6.000    3rd Qu.:7.000
 Max.   :7.000    Max.    :7.000    Max.    :7.000
 Var    :0.775    Var     :0.816    Var     :0.526
```

**How large would you say the difference between 'Log Grip' and 'Floating Steps' is?**

```
[1] n (default) =  70

[1] n (narrower) =  70

[1] n (wider) =  70

     default             wider              narrower
 Min.   :2.000    Min.    :1.000    Min.    :1.000
 1st Qu.:2.000    1st Qu.:2.000    1st Qu.:2.000
 Median :3.000    Median :3.000    Median :3.000
 Mean   :3.057    Mean    :3.057    Mean    :3.214
 3rd Qu.:4.000    3rd Qu.:4.000    3rd Qu.:4.000
 Max.   :7.000    Max.    :5.000    Max.    :7.000
 Var    :1.301    Var     :0.866    Var     :1.214
```

**How many times would you say 'Floating Steps' were used?**

```
[1] n (default) =  70
```

```
[1] n (narrower) =  70

[1] n (wider) =  70
```

```
    default              wider              narrower
 Min.   :26.00     Min.   :24.00      Min.    :23.00
 1st Qu.:27.12     1st Qu.:27.00      1st Qu.:27.00
 Median :28.00     Median :28.00      Median :28.00
 Mean   :27.97     Mean   :28.04      Mean    :27.39
 3rd Qu.:28.00     3rd Qu.:29.00      3rd Qu.:28.00
 Max.   :33.00     Max.   :30.00      Max.    :29.00
 Var    :0.977     Var    :1.93       Var     :0.871
```

```
[1] n (default) =  65

[1] n (narrower) =  67

[1] n (wider) =  70
```

```
    default              wider              narrower
 Min.   :26.00     Min.   :24.00      Min.    :26.00
 1st Qu.:27.00     1st Qu.:27.00      1st Qu.:27.00
 Median :28.00     Median :28.00      Median :28.00
 Mean   :27.76     Mean   :28.04      Mean    :27.53
 3rd Qu.:28.00     3rd Qu.:29.00      3rd Qu.:28.00
 Max.   :29.00     Max.   :30.00      Max.    :29.00
 Var    :0.36      Var    :1.93       Var     :0.336
```

**Comparisons**

|  | Default | Narrower | Wider |
| --- | --- | --- | --- |
| Most aesthetically pleasing? | 37 | 14 | 18 |
| Easiest to read and interpret? | 36 | 15 | 19 |
| Hardest to read and interpret? | 20 | 20 | 30 |

## Ninja Warrior - Part 3

**How many times would you say 'Floating Steps' were used in the Finals (Regional/City) round?**

```
[1] n (stacked) =  70

[1] n (grouped) =  70
```

```
 Stacked            Grouped
 Min.   : 9.00     Min.    :10.0
 1st Qu.:10.00     1st Qu.:11.0
```

```
 Median :11.00    Median :11.0
 Mean   :14.33    Mean   :11.8
 3rd Qu.:14.00    3rd Qu.:12.0
 Max.   :35.00    Max.   :40.0
 Var    :54.83    Var    :13.15
```

[1] Number of outliers (stacked): 12

[1] Number of outliers (grouped): 1

```
          Stacked              Grouped
Min.      9                    10
1st Qu.   10                   11
Median    10                   11
Mean      11.1206896551724 11.3913043478261
3rd Qu.   12                   12
Max.      20                   17
          Var     :3.862   Var     :1.477
```

```
   Min. 1st Qu.  Median   Mean 3rd Qu.    Max.
  27.00   27.75   30.00  29.83   30.00   35.00
```

**Shapiro test for the responses for the stacked bar plot**

```
    Shapiro-Wilk normality test

data:  stacked_1
W = 0.70313, p-value = 1.566e-09
```

**Shapiro test for the responses for the stacked bar plot**

```
    Shapiro-Wilk normality test

data:  grouped_1
W = 0.29757, p-value < 2.2e-16
```

**Sign test for the responses for the stacked bar plot**

```
    One-sample Sign-Test

data:  stacked_1
s = 16, p-value = 0.01535
alternative hypothesis: true median is not equal to 11
```

```
95 percent confidence interval:
 10 11
sample estimates:
median of x
        10
```

Achieved and Interpolated Confidence Intervals:

|                   | Conf.Level | L.E.pt | U.E.pt |
|-------------------|------------|--------|--------|
| Lower Achieved CI | 0.9131     | 10     | 11     |
| Interpolated CI   | 0.9500     | 10     | 11     |
| Upper Achieved CI | 0.9521     | 10     | 11     |

**Sign test for the responses for the grouped bar plot**

```
    One-sample Sign-Test

data:  grouped_1
s = 28, p-value = 0.009475
alternative hypothesis: true median is not equal to 11
95 percent confidence interval:
 11 12
sample estimates:
median of x
        11
```

Achieved and Interpolated Confidence Intervals:

|                   | Conf.Level | L.E.pt | U.E.pt |
|-------------------|------------|--------|--------|
| Lower Achieved CI | 0.9278     | 11     | 12     |
| Interpolated CI   | 0.9500     | 11     | 12     |
| Upper Achieved CI | 0.9586     | 11     | 12     |

**T-test on samples from the distribution of responses for the stacked bar plot**

```
    One Sample t-test

data:  means
t = 4.7579, df = 99, p-value = 6.669e-06
alternative hypothesis: true mean is not equal to 11
95 percent confidence interval:
 11.06216 11.15111
sample estimates:
```

```
mean of x
 11.10664
```

**T-test on samples from the distribution of responses for the grouped bar plot**

```
    One Sample t-test

data:  means
t = 22.601, df = 99, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 11
95 percent confidence interval:
 11.74418 11.88742
sample estimates:
mean of x
  11.8158
```

Running t-tests on the means, however, we see both sets of responses differ statistically significantly from the true value.

**How many times would you say 'Log Grip' was used in the Finals (Regional/City) round?**

```
[1] n (stacked) =  70

[1] n (grouped) =  70

 Stacked          Grouped
 Min.   : 6.00    Min.   : 2.000
 1st Qu.: 8.00    1st Qu.: 8.000
 Median : 9.00    Median : 9.000
 Mean   :10.57    Mean   : 9.057
 3rd Qu.:10.00    3rd Qu.:10.000
 Max.   :25.00    Max.   :15.000
 Var    :23.93    Var    :1.968

[1] Number of outliers (stacked): 11

[1] Number of outliers (grouped): 1

         Stacked           Grouped
Min.     6                 2
1st Qu.  8                 8
Median   8                 9
Mean     8.54237288135593 9.05714285714286
3rd Qu.  10                10
```

```
Max.    11              15
        Var   :1.39     Var    :1.968
```

**Shapiro test for the responses for the stacked bar plot**

```
    Shapiro-Wilk normality test

data:  stacked_2
W = 0.91294, p-value = 0.0004528
```

```
    m-out-of-n bootstrap symmetry test by Miao, Gel, and Gastwirth (2006)

data:  stacked_2
Test statistic = 4.4756, p-value < 2.2e-16
alternative hypothesis: the distribution is asymmetric.
sample estimates:
bootstrap optimal m
               18
```

**Shapiro test for the responses for the stacked bar plot**

```
    Shapiro-Wilk normality test

data:  grouped_2
W = 0.7287, p-value = 4.611e-10
```

```
    m-out-of-n bootstrap symmetry test by Miao, Gel, and Gastwirth (2006)

data:  grouped_2
Test statistic = 0.63113, p-value = 0.706
alternative hypothesis: the distribution is asymmetric.
sample estimates:
bootstrap optimal m
               31
```

**Sign test for the responses for the stacked bar plot**

```
    One-sample Sign-Test

data:  stacked_2
s = 16, p-value = 0.03999
```

```
alternative hypothesis: true median is not equal to 9
95 percent confidence interval:
 8 9
sample estimates:
median of x
         8


Achieved and Interpolated Confidence Intervals:

                   Conf.Level L.E.pt U.E.pt
Lower Achieved CI     0.9326      8      9
Interpolated CI       0.9500      8      9
Upper Achieved CI     0.9637      8      9
```

**Sign test for the responses for the grouped bar plot**

```
     One-sample Sign-Test

data:  grouped_2
s = 23, p-value = 0.644
alternative hypothesis: true median is not equal to 9
95 percent confidence interval:
 9 9
sample estimates:
median of x
         9


Achieved and Interpolated Confidence Intervals:

                   Conf.Level L.E.pt U.E.pt
Lower Achieved CI     0.9278      9      9
Interpolated CI       0.9500      9      9
Upper Achieved CI     0.9586      9      9
```

**T-test on samples from the distribution of responses for the stacked bar plot**

```
     One Sample t-test

data:  means
t = -36.599, df = 99, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 9
95 percent confidence interval:
 8.500816 8.552159
```

```
sample estimates:
mean of x
 8.526488
```

**T-test on samples from the distribution of responses for the grouped bar plot**

```
    One Sample t-test

data:  means
t = 3.8859, df = 99, p-value = 0.0001844
alternative hypothesis: true mean is not equal to 9
95 percent confidence interval:
 9.028363 9.087552
sample estimates:
mean of x
 9.057958
```

**Please select the statement you feel applies to the bar chart above.**

|         | Equal | Less | More |
|---------|-------|------|------|
| Stacked | 27    | 31   | 11   |
| Grouped | 60    | 5    | 2    |

**Which obstacle do you think was used MORE in Finals (Regional/City) rounds, 'Log Grip' or 'Floating Steps'?**

|         | Floating Steps | Log Grip | Both the same |
|---------|----------------|----------|---------------|
| Stacked | 56             | 2        | 12            |
| Grouped | 57             | 4        | 9             |

**Which bar chart do you feel is easiest to read and interpret?**

| Grouped | Stacked |
|---------|---------|
| 59      | 11      |

|       | Grouped | Stacked |
|-------|---------|---------|
| Set A | 10      | 3       |
| Set B | 11      | 1       |
| Set C | 9       | 1       |
| Set D | 11      | 1       |
| Set E | 8       | 3       |
| Set F | 10      | 2       |

**Which colour scheme do you find most aesthetically pleasing?**

| Pairing ID | Main Colour Palette | Secondary Colour Pallette |
|---|---|---|
| A | Viridis | Default |
| B | Default | Viridis |
| C | Default | Greyscale |
| D | Greyscale | Default |
| E | Viridis | Greyscale |
| F | Greyscale | Viridis |

```
        A  B
Set A  7  6
Set B  6  6
Set C  9  1
Set D  3  9
Set E 11  0
Set F  1 11
```

**Do you feel that one of the colour schemes makes it easier to read and interpret? If so, please select which one.**

```
       A  B None
[1,]   7  0    6
[2,] 11  0    1
[3,]   9  1    0
[4,]   2 10    0
[5,] 11  0    0
[6,]   2  9    1
```

## Sales - Part 1

**How much would you say sales of each company increased between January and December? [Company A]**

```
         Separate Truncated   Zeroed
Min.     1.000000  1.000000 1.000000
1st Qu. 2.000000  2.000000 1.000000
Median  3.000000  2.000000 1.000000
Mean    3.043478  2.414286 1.371429
3rd Qu. 4.000000  3.000000 1.750000
Max.    7.000000  7.000000 3.000000
```

**How much would you say sales of each company increased between January and December? [Company B]**

```
         Separate Truncated   Zeroed
Min.     1.000000  1.000000 1.000000
1st Qu. 4.000000  4.000000 2.000000
```

```
Median  5.000000  6.000000 2.000000
Mean    4.826087  5.144928 2.478261
3rd Qu. 6.000000  7.000000 3.000000
Max.    7.000000  7.000000 6.000000
```

How large would you say the drop in sales between April and July of Company A is?

```
        Separate Truncated   Zeroed
Min.    1.000000  1.000000 1.000000
1st Qu. 3.000000  2.000000 1.000000
Median  4.000000  3.000000 1.000000
Mean    4.028571  2.814286 1.571429
3rd Qu. 5.000000  3.000000 2.000000
Max.    7.000000  7.000000 6.000000
```

## Sales - Part 2

Based on the above graph, how large would you say the difference is between the number of sales Company C makes and the number of sales Company D makes?

```
        Truncated Zeroed
Min.     2.000000    1.0
1st Qu.  4.000000    2.0
Median   4.000000    3.0
Mean     4.271429    2.7
3rd Qu.  5.000000    3.0
Max.     7.000000    5.0
```