Measures of Position

Data Science for Quality Management: Describing Data Numerically

with **Wendy Martin**

Learning objectives:

Calculate measures of position

Find the low and high values of a data set

Find sample quartiles and percentiles

Measures of Position

Measures of position, or relative standing, display values representing position or order in the data set or distribution

Measures of Position

They describe the relationship of a measure to the rest of the data

- Low and High
- Percentiles
- Quartiles

Low and High Scores

- Low and high are the lowest and highest values in the data set. These may not exist for populations, unless bounded.

- Symbols: sample (X_L and X_H)

How to Calculate in RStudio

- In R Studio:

```
> min(preform$weight)
> max(preform$weight)
```

Or

```
> summary(preform$weight)
```

Percentiles

- The P^{th} percentile is the value that P% of the values fall at or below and (100 - P%) fall above it
- Symbols: no common symbols used, but generally written simply as ”P^{th} percentile"

Percentiles: Calculations

- First sort the data from low to high
- The Pth percentile is found in the 1+P(n-1)/100th position (P in a proportion)

Percentiles: Example

For our preform data set, 30th percentile:

- Data sorted from low to high:
- 36 36 37 38 39 53 57 58 65 67
- The 30th percentile is found in the 1 + $0.30(n-1)^{th}$ position, or 1 + 0.30(10-1) = 3.7 (between the 3^{rd} and 4^{th} value)

Percentiles: Example

- 36 36 37 38 39 53 57 58 65 67
- Using the fraction of 3.7 (0.7), the percentile is 0.7 times the range between the 3rd and 4th value above the 3rd value or 37+0.7(38-37)
- The 30th percentile is 37.7

How to Calculate in RStudio

- In R Studio:

> quantile(x = preform$weight, probs = 0.30)

Read more at: https://www.rdocumentation.org/packages/stats/versions/3.4.3/topics/quantile

Quartiles

- Quartiles are the 25^{th}, 50^{th}, 75^{th} and 100^{th} percentiles

- Symbols: Q_i

Quartiles: Calculations

- Q1: The 25^{th} percentile, found in the $1+(n-1)/4^{th}$ position $\{1+((n-1)*.25^{th})\}$
- Q2: The median $\{1+(n-1)*.50^{th}\}$
- Q3: The 75^{th} percentile, found in the $1+3(n-1)/4^{th}$ position $\{1+(n-1)*.75^{th}\}$
- Q4: The highest value, X_H

Quartiles: Example

For our preform data set, the 1st and 3rd quartiles are found as follows

- Q1 is found in the (1+(10-1)/4th position or 3.25 = 37.25
- Q3 is found in the (1+3(10-1)/4th position or 7.75 = 57.75

How to Calculate in RStudio

- In R Studio:

> quantile(x = preform$weight, probs = 0.25)

Or

> summary(preform$weight)

Sources

The material used in the PowerPoint presentations associated with this course was drawn from a number of sources. Specifically, much of the content included was adopted or adapted from the following previously-published material:

- Luftig, J. An Introduction to Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1982
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- Littlejohn, R., Ouellette, S., & Petrovich, M. Black Belt Business Improvement Specialist Training, Luftig & Warren International, 2000
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