# The Five-Number Summary

## Lecture 16
## Sections 5.3.1 - 5.3.3

Robb T. Koether

Hampden-Sydney College

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# Outline

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# Percentiles and Quartiles

## Definition ($p^{th}$ Percentile)

The $p^{th}$ percentile of a set of numbers is a number that divides the lower $p$% of the numbers from the rest.

## Definition (1st Quartile)

The 1st quartile, denoted $Q_1$, of a set of numbers is the $25^{th}$ percentile.

## Definition (3rd Quartile)

The 3rd quartile, denoted $Q_3$, of a set of numbers is the $75^{th}$ percentile.

# Finding Quartiles

- To find the quartiles, first find the position of the median.
- Then the 1st quartile is the median of all the numbers that are below that position.
- The 3rd quartile is the median of all the numbers that are above that position.

# Example

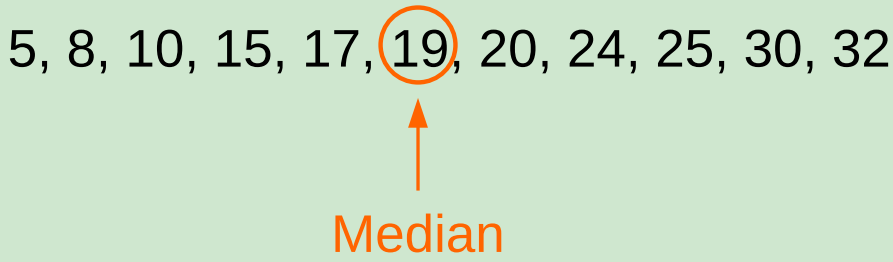
## Example (Quartiles)

5, 8, 10, 15, 17, 19, 20, 24, 25, 30, 32

Find the median and quartiles of the following sample

# Example

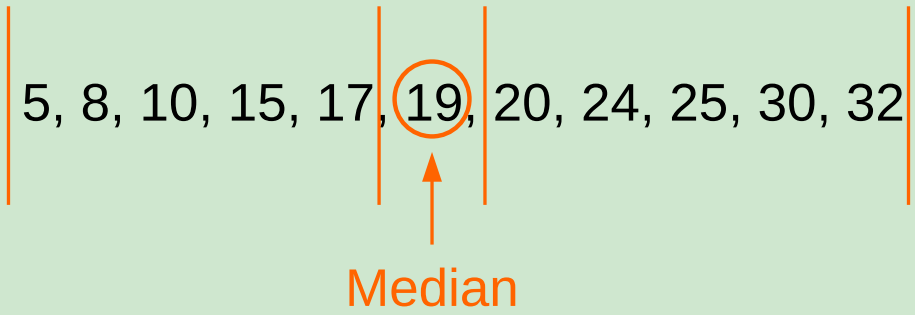
## Example (Quartiles)




First find the median

# Example

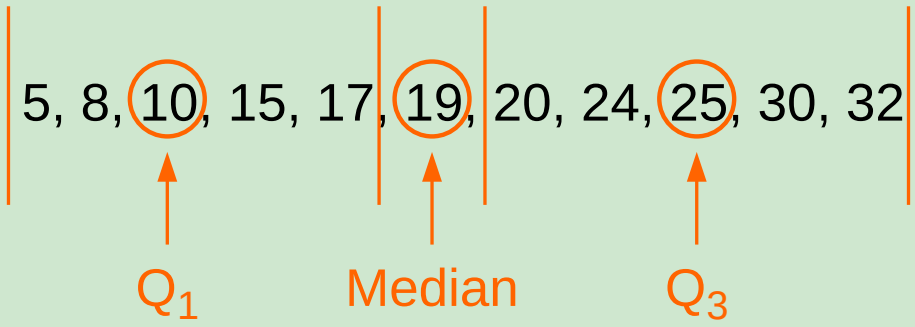
## Example (Quartiles)




Identify the lower and upper halves

# Example

## Example (Quartiles)




Their medians are the quartiles

# Outline

## Definition (Five-Number Summary)

The five-number summary of a set of numbers consists of the five quantities

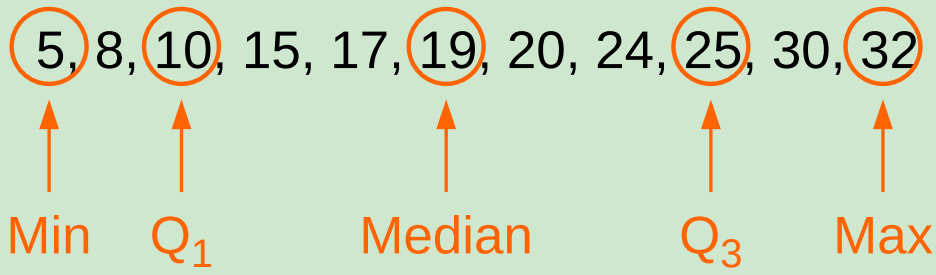
- Minimum
- $1^{st}$ quartile
- Median
- $3^{rd}$ quartile
- Maximum

- These five numbers divide the set of numbers into four groups of equal size, each containing one-fourth of the set.

# Example

## Example (Five-Number Summary)

- The five-number summary of the previous sample is
  - Min$=5$.
  - $Q_1 = 10$.
  - Med$=19$.
  - $Q_3 = 25$.
  - Max$=32$.



# Practice

## Practice

- Find the five-number summary of the 15 test scores.

| | | | | |
|---|---|---|---|---|
| 67 | 69 | 80 | 96 | 91 |
| 67 | 65 | 73 | 94 | 82 |
| 69 | 87 | 76 | 66 | 90 |

# Practice

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- Find the five-number summary of the 16 test scores.

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| 75 | | | | |

# Outline

# TI-83 Five-Number Summary

## TI-83 Five-Number Summary

- Follow the same procedure that was used to find the mean.
- When the list of statistics appears, scroll down to the ones labeled

  `minX`, `Q1`, `Med`, `Q3`, `maxX`.

- They are the five-number summary.

# TI-83 Five-Number Summary

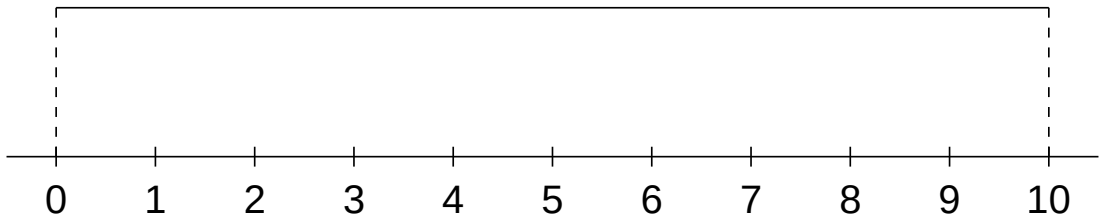
## TI-83 Five-Number Summary

- Use the TI-83 to find the five-number summary of the rainfall data

| | | | | | |
|---|---|---|---|---|---|
| 9.52 | 0.08 | 6.14 | 8.68 | 2.93 | 2.03 |
| 3.60 | 14.71 | 4.01 | 0.85 | 6.89 | 11.07 |
| 4.42 | 3.41 | 2.85 | 2.56 | 1.92 | 5.15 |
| 1.58 | 4.44 | 0.77 | 4.76 | 1.15 | 3.02 |
| 1.73 | 2.60 | 2.56 | 10.01 | 2.46 | 6.49 |

# Five-Number Summaries and Distributions

- If the distribution were uniform from 0 to 10, what would be the five-number summary?



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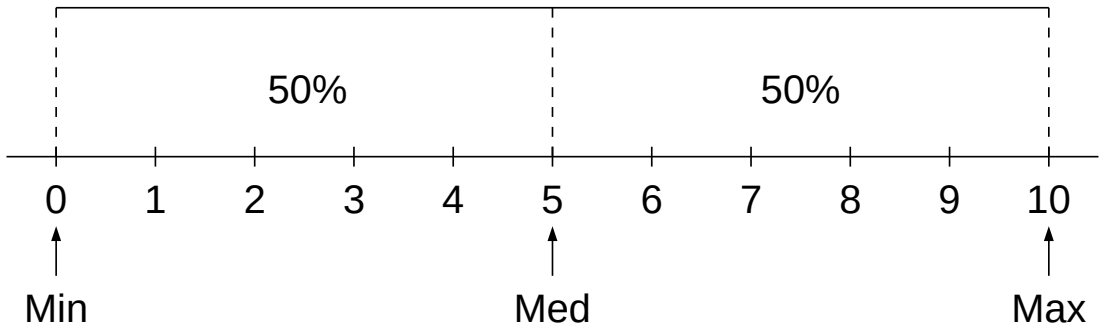

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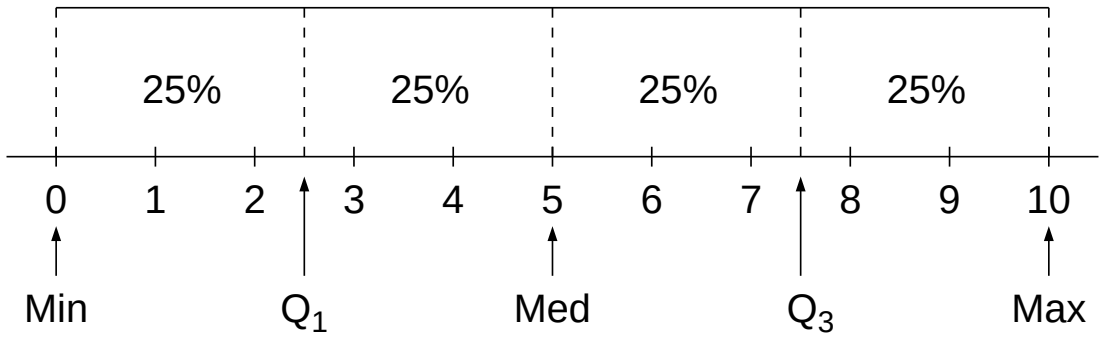
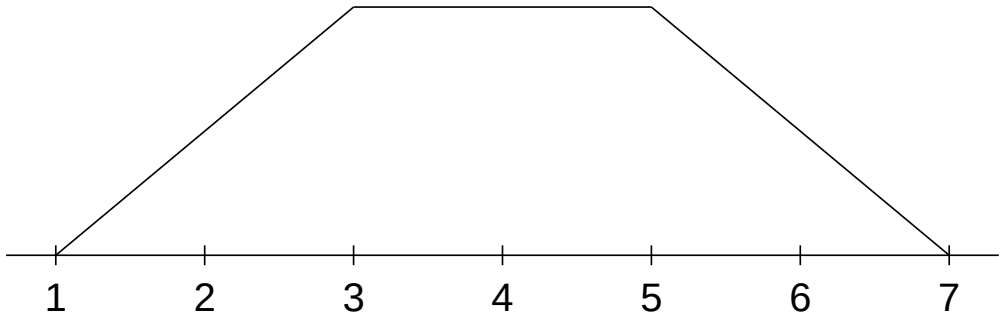


# Five-Number Summaries and Distributions

- Where would the median and quartiles be in this symmetric non-uniform distribution?



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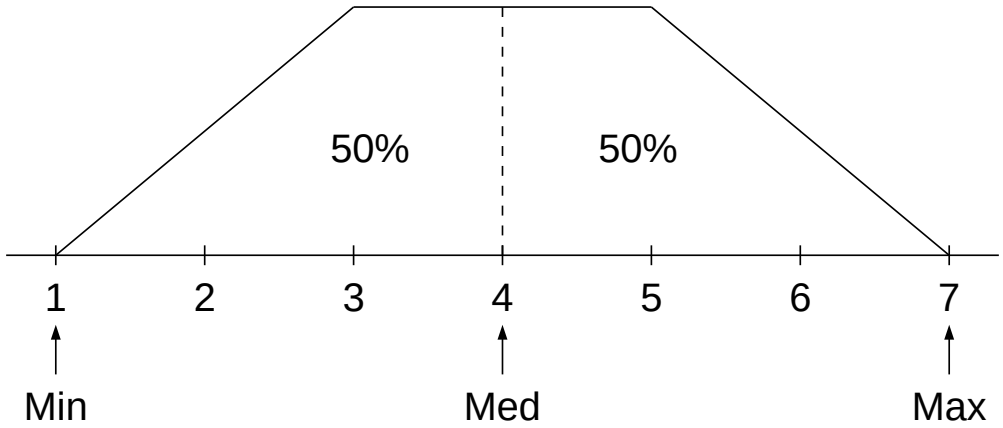

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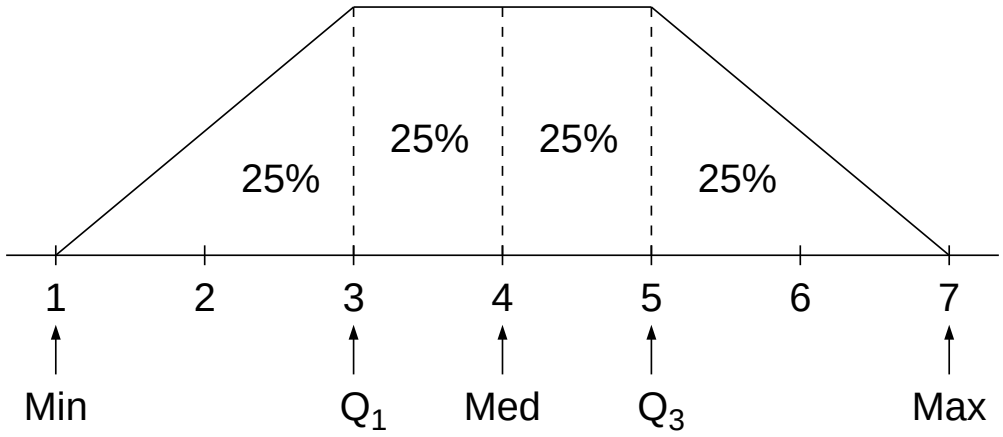

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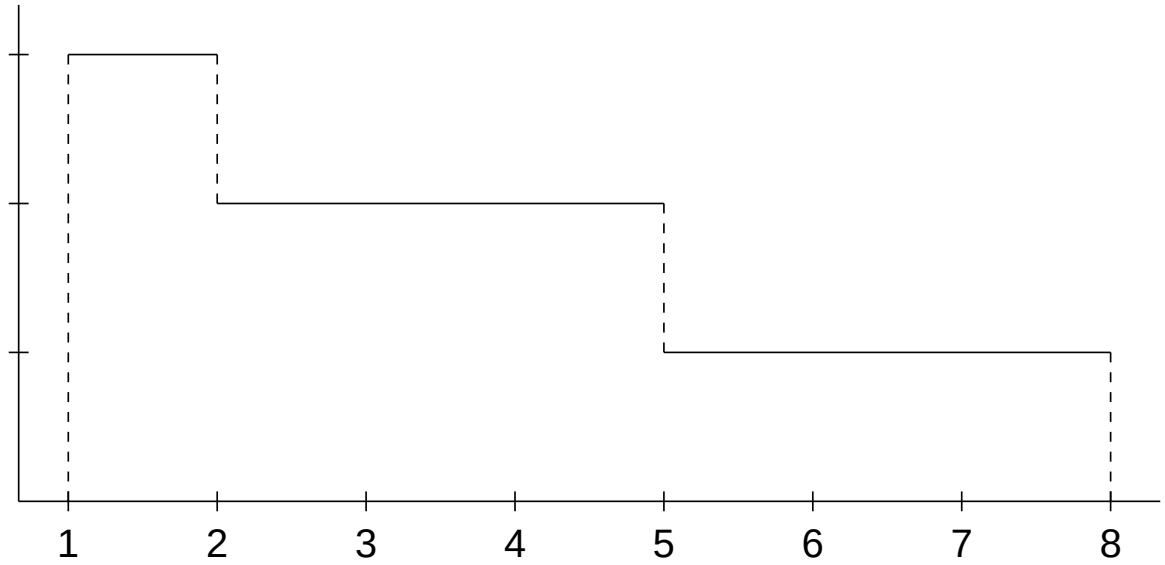

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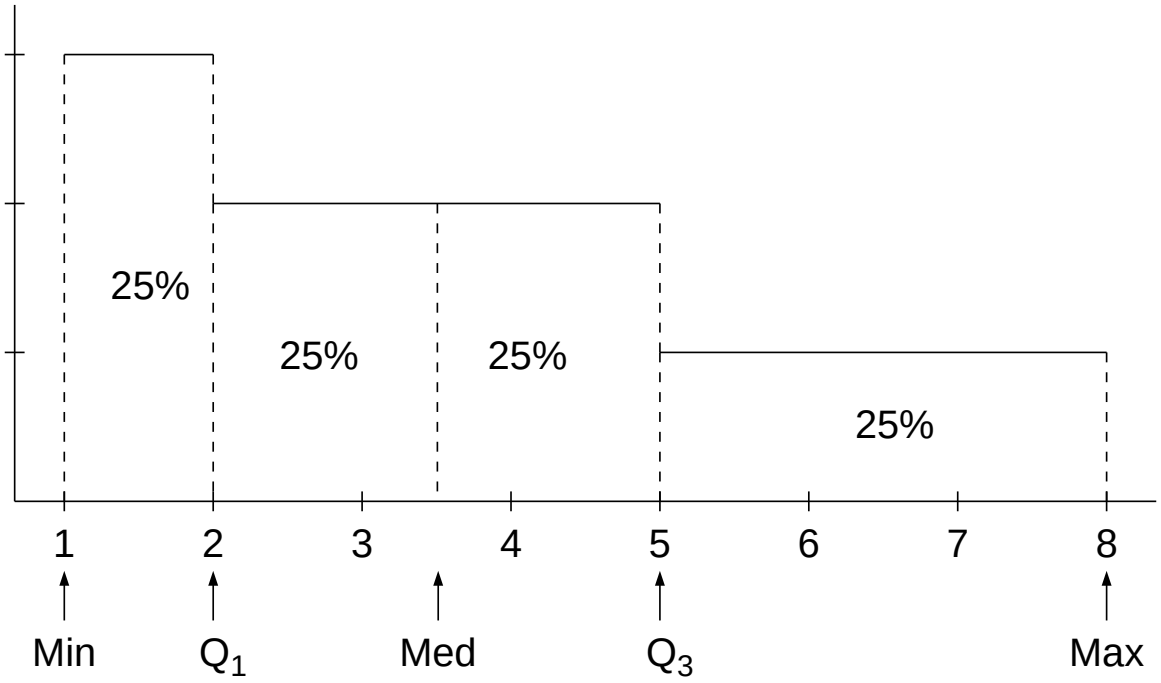
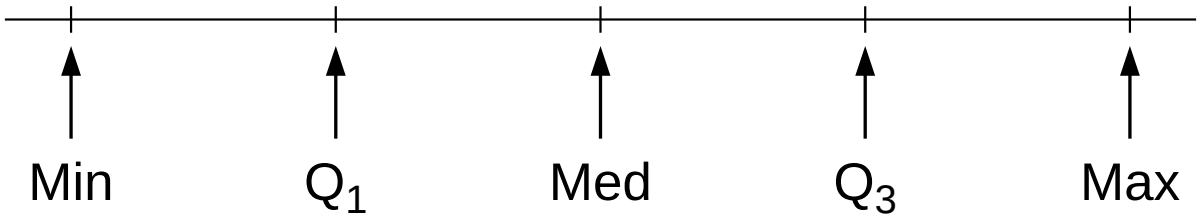


# Five-Number Summaries and Distributions

- Describe the distribution.



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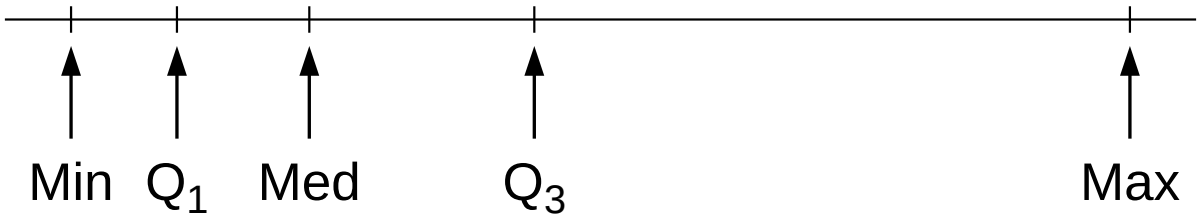

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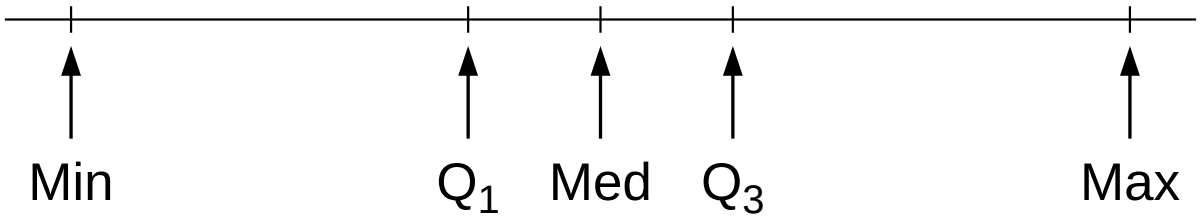

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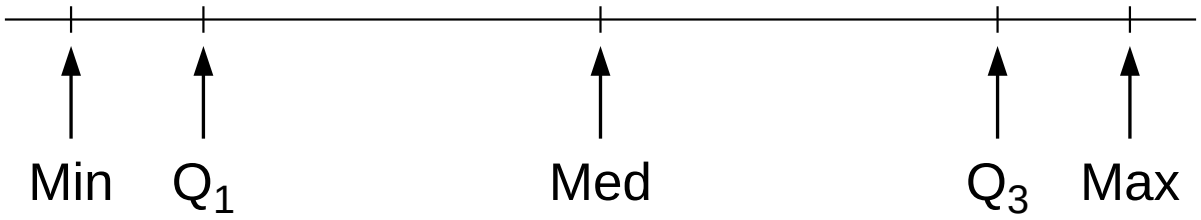

# Outline

# The Interquartile Range

## Definition (Interquartile Range)

The interquartile range, denoted IQR, is the difference between $Q_3$ and $Q_1$.

- The IQR is a commonly used measure of spread, or variability.
- Like the median, it is not affected by extreme outliers.

# The IQR

## Example (IQR)

- The IQR of

$$5, 8, 10, 15, 17, 19, 20, 24, 25, 30, 32$$

is

$$\begin{aligned} \text{IQR} &= Q_3 - Q_1 \\ &= 25 - 10 \\ &= 15 \end{aligned}$$

# The IQR

## Practice

- Find the IQR of the 15 test scores.

| | | | | |
|---|---|---|---|---|
| 67 | 69 | 80 | 96 | 91 |
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# Five-Number Summaries and Stem-and-Leaf Displays

- Use an *ordered* stem-and-leaf display of the 15 test scores to find a five-number summary.

| Stem | Leaf |
|---|---|
| 6 | 5 6 7 7 9 9 |
| 7 | 3 6 |
| 8 | 0 2 7 |
| 9 | 0 1 4 6 |

- Note: 1|2 means 12.

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# Assignment

## Homework

- Read Section 5.3.1 - 5.3.2, pages 312 - 315.
- Work Example 5.4, page 314, as an exercise.