Statistics / Module 5 - Measures of Variation

Module 5 - Measures of Variation

Share

▶

Watch on ▶ YouTube

Topic 1: Range of a data set
Problem 1: Find the range of the data set {3, 7, 9, 12, 15}.
Answer: Range = maximum - minimum = 15 - 3 = 12.

Problem 2: Calculate the range of the data set {4, 8, 2, 10, 6}.
Answer: Range = maximum - minimum = 10 - 2 = 8.

Topic 2: Comparing measures of center and variation

The test scores of the students in four classes are summarized below. Answer the questions about them.

Class A: The mean score is 104 and the range of scores is 58.
Class B: The mean score is 99 and the range of scores is 59.
Class C: The mean score is 97 and the range of scores is 55.
Class D: The mean score is 100 and the range of scores is 50.

(a) Based on the information above, which class's scores have the least variability?

   ○ Class A   ○ Class B   ○ Class C   ○ Class D

(b) Based on the information above, which class has the highest scores on average?
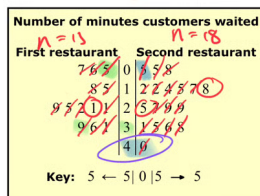
   ○ Class A   ○ Class B   ○ Class C   ○ Class D

Topic 3: Using back-to-back stem-and-leaf displays to compare data sets

The stem-and-leaf display below gives the number of minutes that customers waited for their orders at two different restaurants. There were 13 w
for the first restaurant and 18 recorded for the second. Use the display to answer the questions that follow.

Number of minutes customers waited

First restaurant		Second restaurant
7 6 5	0	5 8
8 5	1	2 2 4 5 7 8
9 5 2 1 4	2	5 7 9 9
9 6 4	3	1 5 6 8
	4	0

Key: 5 ← 5|0|5 → 5

1st: 5, 6, 7, 15, 18, 21, 21, 22, 25, 29, 31, 36, 39

2nd: 5, 5, 8, 12, 12, 14, 15, 17, 18, 25, 27, 29, 29, 31, 35, 36, 38, 40

(a) What were the ranges of wait times for the two restaurants?

First restaurant   □   39 - 5 = 34
Second restaurant   □   40 - 5 = 35

(b) Which restaurant had the greater median wait time? Middle #
○ First restaurant   ● Second restaurant   ○ The medians were the same

(c) Which restaurant had more wait times from 40 to 49 minutes?
○ First restaurant   ● Second restaurant   ○ Each had the same

6 + 1 + 6 = 13
1st: 21
2nd: 18   9 | 9   9th 10th
18 + 25 / 2 = 43 / 2 = 21.5 2nd

Topic 4: Population standard deviation
Problem 1: Calculate the population standard deviation for {2, 4, 6, 8}. Use $\sigma = \sqrt{\Sigma(x - \mu)^2 / N}$.
Answer: Mean μ = (2 + 4 + 6 + 8) / 4 = 20 / 4 = 5. Deviations: $(2-5)^2 = 9$, $(4-5)^2 = 1$, $(6-5)^2 = 1$, $(8-5)^2 = 9$. Variance = (9 + 1 + 1 + 9) / 4 = 20 / 4 = 5. $\sigma = \sqrt{5} \approx 2.24$.

1. Find the mean = 5
2. Fill out the table
    1. Add the last column 9+1+1+9
    2.
3. Divide by n 20/4=5
4. Take the square root sqrt(5)
5.
= 20 = 1.495

| X	X - mean	(X-mean)^2
2	-3	9
4	-1	1
6	1	1
8	3	9

Topic 5: Sample standard deviation
Same numbers as above.
1. Find the mean
2. Fill out the table
3. Add the last column
4. Divide by n-1 20/3=6.67
5. Take the square root sqrt(6.67)
6.
= 1.607

Topic 6: Notation for the population mean, sample mean, population standard deviation, and sample standard deviation

	Sample	Population
Mean	$\bar{x}$	μ
Standard deviation	s	σ
Variance	s^2	σ^2

Topic 7: Comparing standard deviations without calculation

Three distributions, labeled (a), (b), and (c) are represented below by their histograms. Each distributic performing any calculations, order their respective standard deviations σ_a, σ_b, and σ_c.

$$\sigma_{\square}^c < \sigma_{\square}^a < \sigma_{\square}^{d}$$
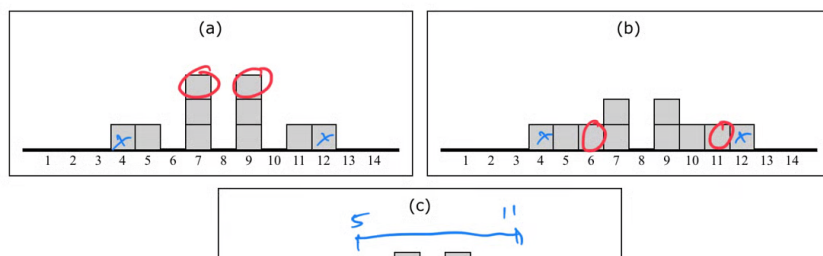
smallest → biggest

Topic 8: Identifying the center, spread, and shape of a data set

Our class recorded the temperature at noon each day for 48 school days in autumn. The lowest temperature (in °F) was 80, and the highest was 87. The table gives the mean, median, range, and interquartile range (IQR) of the data set.

looking at Range and IQR

symmetric
center

Summary values			
Mean	Median	Range	IQR
83.5	83.5	7	4

Variation

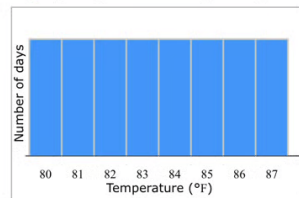**(a)** Select the best description of *spread* for the data set.

- ● The difference between the largest and smallest temperature (in °F) is 7. (This is the range.)
- ○ The difference between the largest and smallest temperature (in °F) is 83.5. (This is the mean.)
- ○ The difference between the largest and smallest temperature (in °F) is 48. (This is the number of days the temperature was recorded.)

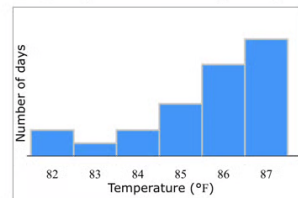**(b)** Select the best description of *center* for the data set.

- ○ Based on the IQR, we see that the "average" temperature (in °F) was about 4. — Skewed
- ● Based on the mean and median, we see that the "average" temperature (in °F) was about 83 or 84.
- ○ Based on the range, we see that the "average" temperature (in °F) was about 7.

(c) Select the graph with the shape that best fits the summary values.

symmetric only if mean = median

- ● Graph 1 (The data set *is* symmetric.)
- ○ Graph 2 (The data set is *not* symmetric.)

Activity: