

Exam Stats

$$\text{Mean} = 91.4$$

$$\text{Median} = 95$$

A	90-100
B	80-89
C	65-79
D	50-64

Question: How can we measure how spread out a set of data is?

I) Range

• Difference between highest and lowest value

Example: 1, 2, 5, 7, 12, 15, 18

$$\text{Range} = 18 - 1 = 17$$

II) Variance / Standard Deviation

- Measures how far away the values are from the mean

Example: Test scores in a 5-person class

80, 87, 82, 92, 84

Step 1: Compute mean $\frac{80 + 87 + 82 + 92 + 84}{5} = 85$

Step 2: Find deviations (value-mean)

Grade	Deviations	Squared Deviations
80	$80 - 85 = -5$	25
87	$87 - 85 = 2$	4
82	$82 - 85 = -3$	9
92	$92 - 85 = 7$	49
84	$84 - 85 = -1$ +	1
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Step 3: Square Deviations

Step 4: Find mean of squared deviations

$$\frac{25+4+9+49+1}{5} = 17.6 = \sigma^2$$

Population
Variance

Step 5: Take square root of variance to find standard deviation

$$\sigma^2 = 17.6$$

$$\sigma = \sqrt{17.6} = 4.20$$

Population
Standard Deviation

If we have a sample instead of the entire population, we change step 4, to dividing by $n-1$, where n is the size of our sample

Example: Class of 23 students, 5 sampled got scores 80, 87, 82, 92, 84

Steps 1-3: Exact same

Step 4: $\frac{25+4+9+49+1}{4} = 22 = S^2$ Sample Variance

Step 5: $S = \sqrt{22} = 4.69$ Sample Standard Deviation

Measurements of position

I) Rank

- Student finishes 3rd in class of 54 students
- Runner finishes 15th in a race of 150 athletes

II) Percentile

Score at the 84th percentile \rightarrow 84% of people scored the same or lower, and 16% scored higher.

Example: Exam scores 80, 87, 82, 92, 84

82 is at the 40th percentile

III) z-score

- Measures how many standard deviation from the mean we are.

$$z = \frac{\text{Score} - \text{Mean}}{\text{std dev}}.$$

Example: $\mu = 85$, $\sigma = 5$. The score 92 has z-score

of
$$z = \frac{92 - 85}{5} = \frac{7}{5} = 1.4$$

70 has z-score of

$$z = \frac{70 - 85}{5} = \frac{-15}{5} = -3$$