5.3

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FOM 11 **5.3 Standard Deviation**

To describe data numerically, we often use two numbers:

1. **Mean**: the average

   Let $x_1, x_2, x_3, ..., x_n$ represent any set of values.

   Mean: $\bar{x} = \mu = \frac{\sum x_i}{n}$

2. **Standard Deviation:** a measure of the extent to which data cluster around the mean.

   Let $x_1, x_2, x_3, ..., x_n$ represent any set of values.

   Standard Deviation: $\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{n}}$

   The smaller the standard deviation, the more consistent the results and the closer the data to the mean.

Example 1: Calculate the standard deviation from the following sets of values:

a. 7, 8, 9, 10, 11

b. 7, 9, 11, 13, 15

Grouped Data

Example 2: Calculate the standard deviation for the following sets of data:

a.

Midpoint	Daily Commute Time (min)	Number of Employees (frequency)
5	0-10	4
15 ($\frac{10+20}{2}$ = 15)	10-20	9
25	20-30	6
35	30-40	4
45	40-50	2

Total: 25

mean $= \bar{x} = \mu$

$= \frac{4(5)+9(15)+6(25)+4(35)+2(45)}{25}$ ← total

$= \frac{535}{25} = \boxed{21.4 = \bar{x}}$

$$\sigma = \sqrt{\frac{\sum (f)(x-\bar{x})^2}{n}}$$

(f = frequency, x = midpoint)

$$= \sqrt{\frac{4(5-21.4)^2+9(15-21.4)^2+6(25-21.4)^2+4(35-21.4)^2+2(45-21.4)^2}{25}}$$

$$= \sqrt{\frac{4(268.96)+9(40.96)+6(12.96)+4(184.96)+2(556.96)}{25}}$$

$$= \sqrt{\frac{3376}{25}} = \boxed{11.62}$$

b.

Midpoint	# of Orders	# of Days (frequency)
$\frac{10+12}{2}=\frac{22}{2}=11$	10-12	4
14	13-15	12
17	16-18	20
20	19-21	14
	Total:	50

mean $= \bar{x} = \mu$

$= \frac{4(11)+12(14)+20(17)+14(20)}{50}$

$\bar{x} = 16.64$

$\sigma = \sqrt{\frac{4(11-16.64)^2+12(14-16.64)^2+20(17-16.64)^2+14(20-16.64)^2}{50}}$

$= \sqrt{\frac{127.24+83.64+2.59+158.05}{50}} = \sqrt{\frac{371.52}{50}}$

$= \sqrt{7.43}$

$= 2.725$

≈ 2.73

more consistent (lower σ)

Assignment: Pg. 233 #1-3, 5, 6, 8, 11, 14