

Chapter 5: Exploring Data: Distributions

For All Practical
Purposes



Mathematical Literacy in
Today's World, 9th ed.

Section 5.4 Describing Center: Mean and Median

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- Two Most Common Ways to Describe the Center: Mean and Median

- Mean “average value”

- Ordinary arithmetic average of a set of observations, *average value*.
- To find mean of a set of observations, add their values, $(x_1, x_2, x_3, \dots, x_n)$ and divide by the number of observations, n .
- *x-bar*, $\bar{x} = (x_1 + x_2 + \dots + x_n)/n$

- Median “middle value”

- The midpoint or center of an ordered list; *middle value* of a set of observations; half fall below the median and half fall above.
- Arrange observations in increasing order (smallest to largest).
- If the number of observations is odd, the median M is the center observation in the ordered list.
- If the number of observations is even, the median M is the average of the two center observations in the ordered list.

Example *Calculating the Mean*

27 50 33 25 86 25 85 31 37 44 20 36 59 34 28

The mean of these 15 numbers is

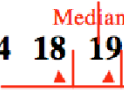
$$\bar{x} = \frac{27 + 50 + 33 + \cdots + 28}{15} = \frac{620}{15} = 41.3$$

Example *Calculating the Median*

20 25 25 27 28 31 33 34 36 37 44 50 59 85 86

n=15 $\frac{n+1}{2} = \frac{16}{2} = 8$  Therefore Median=34

5 7 10 14 18 19 25 29 31 33

n=10 $\frac{n+1}{2} = \frac{11}{2} = 5.5$  Therefore Median = $\frac{18+19}{2} = 18.5$

• Finding the Mean and Median

Mean *average value*,

\bar{x}
The mean city mileage for the 13 cars in Table 5.2:

$$\bar{x} = \frac{17+17+19+18+22+17+16+24+18+21+19+22+51}{13}$$

$$= 21.6 \text{ mpg}$$

Median *middle value*, M

Arrange observations in order, then choose the middle value: 16 17 17 17 18 18 19 19 21 22 22 24 51

The median city mileage for the 13 cars in Table 5.2:

For 13 cars (odd): $(n + 1)/2 = (13 + 1) / 2 = 7$

The 7th observation is 19 (in red above), the median.

Note: If the Toyota Prius is removed there are 12 observations

(even): $(n + 1)/2 = (12 + 1)/2 = 6.5$

Median = Average of 6th and 7th value $(18 + 19)/2 = 18.5$

Table 5.2

Fuel Economy (Miles per Gallon) for Model Year 2011 Vehicles

Model	City Mileage	Highway Mileage
Acura RL	17	24
BMW 550i	17	25
Buick Regal	19	30
Cadillac STS	18	27
Chevrolet Malibu	22	33
Ford Fusion AWD	17	24
Infiniti MF6	16	25
Ria Optima M6	24	35
Lexus GS250 AWD	18	25
Mitsubishi Galant	21	30
Nissan Maxima	19	26
Toyota Camry	22	32
Toyota Prius	51	48

- **Mode**, *most frequent value*

- Since 17 appears 3 times and no other mileage appears in the list of city mileages more than twice, then the mode of the data set would be 17.
- If there is a tie for the most occurrences in a data set, then there may be multiple modes.
- Example: For the highway mileages, since 25 appears the most times, then it is the mode.

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Buick Regal	19	30
Cadillac STS	18	27
Chevrolet Malibu	22	33
Ford Fusion AWD	17	24
Infiniti M56	16	25
Kia Optima M6	24	35
Lexus GS350 AWD	18	25
Mitsubishi Galant	21	30
Nissan Maxima	19	26
Toyota Camry	22	32
Toyota Prius	51	48