



Measures of Central Tendency

CENTRAL TENDENCY



central tendency is a single value that describes the most typical or representative score in an entire distribution.

mode, the median, and the mean.

THE MODE



The **mode (MO)** specifies the score value with the highest frequency in a set of scores.

To determine the mode, simply arrange the scores in descending order (or create a frequency distribution if there are numerous scores).

Once they are arranged so, it is easy to see at a glance which score occurred with the greatest frequency.

In the set of scores below, 73, 73, 72, 70, 68, 68, 68, 68, 59, 59, 59, 55
 $MO = 68$.



Grouped frequency distribution:

the mode would be the ***mid-point of the class interval with the greatest frequency.***

<i>Class intervals</i>	<i>Midpoint</i>	<i>f</i>	<i>Class intervals</i>	<i>Midpoint</i>	<i>f</i>
36–38	37	8	21–23	22	20
33–35	34	11	18–20	19	16
30–32	31	18	15–17	16	12
27–29	28	26	12–14	13	7
24–26	25	32	9–11	10	3

the mode would be 25.

THE MEDIAN



Median (Mdn): which is the middle point in a distribution.

To find the median for an *odd number of scores*

- *Arrange the scores in descending order from highest to lowest.*
- *The location of the median will be the score that has an equal number of scores above and below as determined by: $N + 1 / 2$*

26, 25, 24, 20, 18, 17, 17, 15, 12

$$(9 + 1) / 2 = 5$$



To find the median for an even number of scores:

- Arrange the scores in order from highest to lowest.
 - Divide the distribution in half and draw a line between the two scores that separate the distribution in to halves.
 - Add the two middle scores that surround the halfway point and divide by 2.
- The resulting value will be the median.

92, 91, 90, 90, 87, 82, | 77, 75, 75, 70, 68, 60

Middle Scores

$$Mdn = \frac{82 + 77}{2} = 79.5$$

THE MEDIAN



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$$(9 + 1) / 2 = 5$$

- A. Last year, 11 employees of a lawnmower manufacturing company retired. Their retirement ages are listed below. What was the median retirement age?

65, 67, 73, 64, 78, 60, 56, 70, 62, 66, 65

Mdn = _____

- B. Determine the median number of haircuts given on one Saturday by each of 12 stylists at Pro Cut Salon:

10, 8, 21, 7, 15, 8, 5, 14, 10, 7, 3, 17

Mdn = _____

The formula method for determining the median is used when you are working from a grouped frequency distribution and the cumulative frequency of the scores has been included.

$$Mdn = LL + \left(\frac{50\% \text{ of } N - cf_{\text{below}}}{f_{wi}} \right) i$$

where: LL = lower limit of the class interval that contains the median
N = number of scores
 cf_{below} = cumulative frequency below the class interval that contains the median
 f_{wi} = frequency of scores in the interval that contains the median
i = size of class interval

For Example

<i>Class interval</i>	<i>f</i>	<i>cf</i>
42–44	4	124 $\rightarrow N$
39–41	8	120
36–38	10	112
33–35	11	102
30–32	8	91
27–29	18	83
24–26	17	65
21–23	16	48
18–20	10	32
15–17	11	22
12–14	5	11
9–11	6	6

The elements of the formula are as follows:

- The lower limit of the interval that contains the median is 23.5.
 - N is 124. We have already established that 50% of $N = 62$, which is the point that divides the distribution in half.
- The cf below the interval that contains the median is 48.
- The frequency of scores in the interval that contains the median (f_{wi}) is 17.
- The size of the class interval is 3.

$$\begin{aligned}Mdn &= 23.5 + \left(\frac{62 - 48}{17} \right) (3) \\&= 23.5 + 2.47 \\&= 25.97\end{aligned}$$

Class intervals	f	cf
60-64	2	60
55-59	1	58
50-54	0	57
45-49	5	57
40-44	0	52
35-39	7	52
30-34	13	45
25-29	12	32
20-24	8	20
15-19	5	12
10-14	0	7
5-9	5	7
0-4	2	2

$$Mdn = LL + \left(\frac{50\% \text{ of } N - cf_{\text{below}}}{f_{wt}} \right) i$$

$$Mdn = \underline{\hspace{2cm}}$$

THE MEAN *is the sum total of all of the scores in a distribution divided by the total number of scores.*

For a population,

$$\mu = \frac{\Sigma X}{N}$$

For a sample,

$$M = \frac{\Sigma X}{n}$$

Let us calculate the mean for the following set of scores from a population:

78, 63, 42, 98, 87, 52, 72, 64, 75, 89

$$\mu = \frac{\Sigma X}{N} = \frac{720}{10} = 72$$

The mean for the following set of scores from a sample involves the same set of calculations:

3, 8, 6, 9, 10, 17, 5, 8, 1

$$M = \frac{\Sigma X}{n} = \frac{67}{9} = 7.44$$

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Mean for a Simple Frequency Distribution

To calculate the mean for scores that have been arranged into a simple frequency distribution, the formula is modified as follows:

For a population,

$$\mu = \frac{\Sigma fX}{N}$$

For a sample,

$$M = \frac{\Sigma fX}{n}$$

where: fX = frequency of the score multiplied by the score itself.

Let us calculate the mean for the following scores from a sample arranged into a simple frequency distribution table:

X	f	fX	X	f	fX
48	1	48	41	4	164
47	4	188	40	6	240
46	2	92	39	3	117
45	4	180	38	0	0
44	9	396	37	1	37
43	8	344	36	2	72
42	5	210	35	1	35
			$n = 50$		$\Sigma fX = 2123$

$$M = \frac{\Sigma fX}{n} = \frac{2123}{50} = 42.46$$

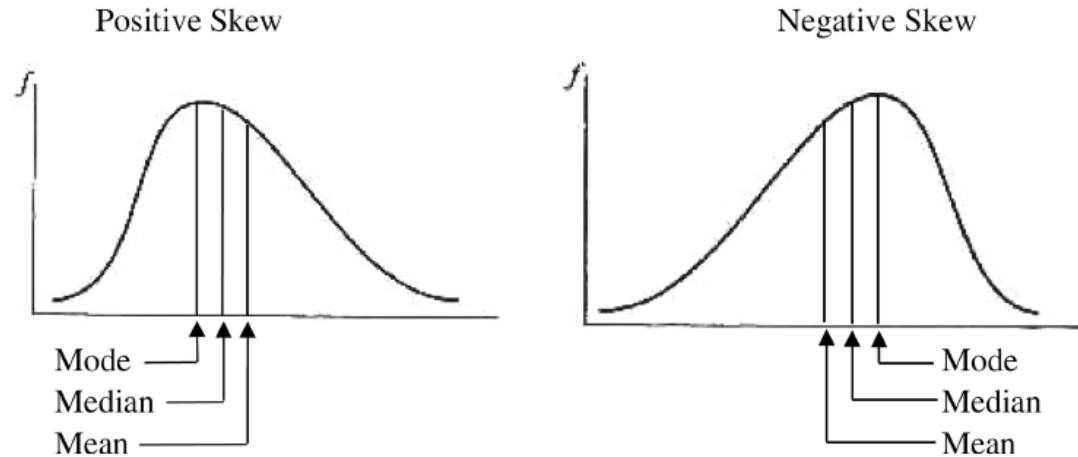
Mean for a Grouped Frequency Distribution

<i>Class interval</i>	<i>Midpoint (X)</i>	<i>f</i>	<i>fX</i>
36–38	37	4	148
33–35	34	3	102
30–32	31	1	31
27–29	28	4	112
24–26	25	7	175
21–23	22	6	132
18–20	19	6	114
15–17	16	2	32
12–14	13	0	0
9–11	10	3	30
		$n = 36$	$\Sigma fX = 876$

$$M = \frac{\Sigma fX}{n} = \frac{876}{36} = 24.33$$

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In *skewed distributions*, the mode would again be at the peak; the mean would be located toward the tails in the direction of the skew (having been affected by either high or low extreme scores); and the median would be between the mode and the mean (so that half the scores lie above it and half below it).



In a negatively skewed distribution, Tyron's score was the same as the median, Jorge's score was the same as the mode, and Geraldine's score was the same as the mean.

- a. Who scored the highest?
- b. Who scored the lowest?



In a distribution of scores, the mode was 68, the median was 59, and the mean was 47. What shape is the distribution?



In a distribution of scores, the median was 60, the mean was 98, and the mode was 42. What is the shape of the distribution?

