

Ukuran Statistik / *Tendency Central*

Rata-rata, Standar Deviasi, Modus, Median, Kuartil, Desil, Rata-rata Ukur & Rata-rata Harmonis

Tinjauan :

Data **Tidak Dikelompokkan** &
Data di **Kelompokkan (Dist. Frek.)**

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Data tidak di-kelompokkan

- Data yg tidak dikelompokkan :
 1. Rata-rata : [1].Rata-rata (mean). [2].Rata-rata alternatif & [3].Rata-rata beberapa perioda.
 2. Standar Deviasi.
 3. Median : didasarkan jumlah data ganjil & genapnya.
[1].n-ganjil. [2].n-genap $\rightarrow X_{n/2} = X_{n/2 + 1}$. [3].n-genap
 $\rightarrow X_{n/2} \neq X_{n/2 + 1}$
 4. Modus : [1].mayoritas tunggal [2].mayoritas ganda

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The Greek alphabet

Letter name	Uppercase	Lowercase	Letter name	Uppercase	Lowercase
Alpha	A	α	Nu	N	ν
Beta	B	β	Xi	Ξ	ξ
Gamma	Γ	γ	Omicron	O	o
Delta	Δ	δ	Pi	Π	π
Epsilon	E	ϵ	Rho	P	ρ
Zeta	Z	ζ	Sigma	Σ	σ
Eta	H	η	Tau	T	τ
Theta	Θ	θ	Upsilon	Υ	υ
Iota	I	ι	Phi	Φ	ϕ
Kappa	K	κ	Chi	X	χ
Lambda	Λ	λ	Psi	Ψ	ψ
Mu	M	μ	Omega	Ω	ω

The **mean** of a data set is another name for the arithmetic average of the data values in the data set. Thus, the mean = $\frac{\text{sum of the data values}}{\text{number of data values}}$. This definition can be

expressed as the following formula: mean = $\frac{\sum x}{n}$, where $\sum x$ represents the sum of all the data values, and n represents the number of data values in the data set.

Find the mean for each of the following data sets.

a. 25, 43, 40, 60, 12

b. -7, 22, -7, 8, 16, 1

c. 6.7, 7.6, 7.5, 6.9, 9.3, 6.7, 7.6, 8.5

Mean

$$\text{a. mean} = \frac{\sum x}{n} = \frac{25 + 43 + 40 + 60 + 12}{5} = \frac{180}{5} = 36$$

$$\text{b. mean} = \frac{\sum x}{n} = \frac{-7 + 22 - 7 + 8 + 16 + 1}{6} = \frac{33}{6} = 5.5$$

$$\begin{aligned} \text{c. mean} &= \frac{\sum x}{n} = \frac{6.7 + 7.6 + 7.5 + 6.9 + 9.3 + 6.7 + 7.6 + 8.5}{8} \\ &= \frac{60.8}{8} = 7.6 \end{aligned}$$

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[1.1] Rata-rata Tidak di Kelompokkan

$$\text{mean} = \frac{\text{sum of the data values}}{\text{number of data values}}$$

No	X_i
1	7
2	5
3	7
4	8
5	9
Jumlah	36

$$\text{mean} = \frac{\sum x}{n}$$

$$\text{RATA-RATA TIDAK DIKELOMPOKKAN} \\ = 36/5 = 7,2$$

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[1.2] Rata-rata Tidak di Kelompokkan

$$\bar{x} = x_0 + \frac{\sum(x_i - x_0)}{n}$$

x_0 tentukan dulu

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X_i	$X_i - X_0$
7	2
5	0
7	2
8	3
9	4
Jumlah	11

Rata-rata $x =$

7.2

x_0 tentukan dulu

7

X_i	$X_i - X_0$
7	0
5	-2
7	0
8	1
9	2
Jumlah	1

Rata-rata $x =$

7.2

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[1.3] Rata-rata Tidak di Kelompokkan

Rata-rata beberapa periode

$$\bar{x} = \frac{n_1 \cdot \bar{x}_1 + n_2 \cdot \bar{x}_2 + \dots + n_i \cdot \bar{x}_i}{n_1 + n_2 + \dots + n_i}$$

BULAN 1
7
5
7
8
9

BULAN 2
7
5
7
8
9
7

BULAN 3
7
5
7
8
9
9

Jumlah Data per-bulan	5
Jumlah Per-Bulan	36
Rata-rata Bulan ke-n	7.200

6
43
7.167

6
45
7.500

Maka, Rata-rata seluruhnya =

7.294

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Variance and standard deviation

1. The symbol for the population variance is σ^2 .
2. The symbol for the sample variance is s^2 .
3. The symbol for the population standard deviation is σ .
4. The symbol for the sample standard deviation is s .
5. The formula for the population variance is $\sigma^2 = \frac{\sum (x_i - \mu)^2}{N}$, where x_i is the i th data value from the population, μ is the population mean, and N is the size of the population.
6. The formula for the sample variance is $s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$, where x_i is the i th data value from the sample, \bar{x} is the sample mean, and n is the size of the sample.
7. The formula for the population standard deviation is $\sigma = \sqrt{\sigma^2} = \sqrt{\frac{\sum (x_i - \mu)^2}{N}}$.
8. The formula for the sample standard deviation is $s = \sqrt{s^2} = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$.

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Variance and standard deviation

Find the (a) sample variance and (b) sample standard deviation for the following data set: 25, 43, 40, 60, 12.

$$(a) \text{ mean} = \bar{x} = \frac{\sum x}{n} = \frac{25+43+40+60+12}{5} = \frac{180}{5} = 36$$

$$\begin{aligned} \text{variance} = s^2 &= \frac{\sum (x_i - \bar{x})^2}{n-1} \\ &= \frac{(25-36)^2 + (43-36)^2 + (40-36)^2 + (60-36)^2 + (12-36)^2}{4} \\ &= \frac{(-11)^2 + (7)^2 + (4)^2 + (24)^2 + (-24)^2}{4} = \frac{1338}{4} = 334.5 \end{aligned}$$

$$(b) \text{ standard deviation} = s = \sqrt{s^2} = \sqrt{334.5} = 18.2893$$

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[2] Standar Deviasi - Data tidak dikelompokkan

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

$$s = \sqrt{s^2} = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

Standart Deviasi yg TIDAK di Kelompokkan

No	X_i	$(X_i - \bar{X})^2$
1	7	0,04
2	5	4,84
3	7	0,04
4	8	0,64
5	9	3,24
Jumlah		8,80

$(7-7.2)^2$

Standar Deviasi yg tidak dikelompokkan :

$$= \text{SQRT}(8,80/5)$$

1,327

$$= \text{SQRT}(8,80/4)$$

1,483

- Standar Deviasi = $s \rightarrow$ Varians = s^2

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The **mode** is the data value (or values) that occurs with the greatest frequency in a data set. A data set in which each data value occurs the same number of times has **no mode**. If only one data value occurs with the greatest frequency, the data set is **unimodal**; that is, it has one mode. If exactly two data values occur with the same frequency that is greater than any of the other frequencies, the data set is **bimodal**; that is, it has two modes. If more than two data values occur with the same frequency that is greater than any of the other frequencies, the data set is **multimodal**; that is, it has more than two modes.

Find the mode, if any, for each of the following data sets. For the data sets that have modes, state whether the data set is unimodal, bimodal, or multimodal.

- 25, 43, 40, 60, 12
- 7, 22, -7, 8, 16, 1
- 6.7, 7.6, 7.5, 6.9, 9.3, 6.7, 7.6, 8.5

Mode

- There is no mode because each data value occurs only once.
- The number -7 is the mode because it is the value that occurs most often. The data set is unimodal.
- The numbers 6.7 and 7.6 are both modes because they occur with the same frequency that is greater than any of the other frequencies. The data set is bimodal.

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[4] Modus – tidak dikelompokkan

Modus yg tidak dikelompokkan

modus = data yg frekuensi pemunculannya paling sering/besar

#1	#2	#3.1	#3.2	#3.3
7	7	7	9	7
5	5	5	9	9
7	7	7	8	9
8	8	8	7	8
9	9	9	7	7
9	7	9	5	5
=MODE(7;5;7;8;9)	=MODE(7;5;7;8;9;7)	=MODE(7;5;7;8;9;9)	=MODE(9;9;8;7;7;5)	=MODE(7;9;9;8;7;5)
7	7	7	9	7
tidak ada modus				

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The **median** is the middle value or the arithmetic average of the two middle values in an *ordered set* of data. You find the median of a data set using a two-step process:

1. Put the data values in order from least to greatest (or greatest to least).
2. Locate the middle data value. If there is no single middle data value, compute the arithmetic average of the two middle data values.

Find the median for each of the following data sets.

a. 25, 43, 40, 60, 12

b. -7, 22, -7, 8, 16, 1

c. 6.7, 7.6, 7.5, 6.9, 9.3, 6.7, 7.6, 8.5

a. 1. Order the numbers: 12, 25, 40, 43, 60.

2. The median is 40, the middle number.

b. 1. Order the numbers: -7, -7, 1, 8, 16, 22.

2. The median is $\frac{1+8}{2} = 4.5$, the arithmetic average of the two middle numbers, 1 and 8.

c. 1. Order the numbers: 6.7, 6.7, 6.9, 7.5, 7.6, 7.6, 8.5, 9.3.

2. The median is $\frac{7.5+7.6}{2} = 7.55$, the arithmetic average of the two middle numbers, 7.5 and 7.6.

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Median

[3] Median – tidak dikelompokkan

Median yg tidak dikelompokkan :

Urutkan ascending (dr kecil ke besar)

Asli	Urut	Ke-i
7	5	x_1
5	7	x_2
7	7	x_3
8	8	x_4
9	9	x_5

n ganjil = 5

$m_d = \text{urutan ke } (n+1)/2$

$m_d = \text{urutan ke } (5+1)/2 = x_3 = 7$

Median yg tidak dikelompokkan :

Urutkan ascending (dr kecil ke besar)

Asli	Urut	Ke-i
7	5	x_1
5	7	x_2
7	7	x_3
8	7	x_4
9	8	x_5
7	9	x_6

n genap = 6

Urutan ke $(n/2) = (n/2) + 1$?

$x_{6/2} = x_{6/2+1} \quad m_d = x_3 = x_4 = 7$

n genap = 6

Urutan ke $(n/2) \neq (n/2) + 1$?

$x_{6/2} \neq x_{6/2+1} \quad m_d = (x_3 + x_4)/2 = 7,5$

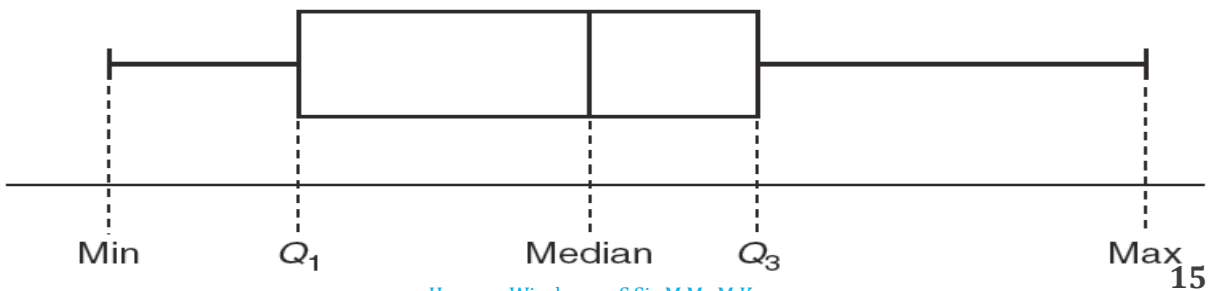
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Sometimes it's difficult to make sense of large data sets. One helpful way to make it easier to harvest information from the data is to "summarize" it using the five-number summary. For a data set, the five-number summary is a set of five measures:

1. The minimum data value, Min
2. The first quartile, Q_1
3. The median of the data set, Med
4. The third quartile, Q_3
5. The maximum data value, Max

Five-number summary

Box-and-whiskers plot.



Excel Functions

Statistical Operations

Table 1 Excel Functions That Perform Statistical Operations

The Function Name	What It Does
AVERAGE	Returns the average of its arguments
CHIDIST	Returns the one-tailed probability of the chi-squared distribution
CHITEST	Returns the test for independence
CORREL	Returns the correlation coefficient between two data sets
FDIST	Returns the F probability distribution
FORECAST	Returns a value along a linear trend
FREQUENCY	Returns a frequency distribution as a vertical array
FTEST	Returns the result of an F test
GEOMEAN	Returns the geometric mean
KURT	Returns the kurtosis of a data set
LINEST	Returns the parameters of a linear trend
MEDIAN	Returns the median of the given numbers
MODE	Returns the most common value in a data set
NORMDIST	Returns the normal cumulative distribution
NORMSDIST	Returns the standard normal cumulative distribution
PEARSON	Returns the Pearson product moment correlation coefficient
QUARTILE	Returns the quartile of a data set
SKEW	Returns the skewness of a distribution
SLOPE	Returns the slope of the linear regression line
STANDARDIZE	Returns a normalized value
STDEV	Estimates standard deviation based on a sample
STDEVA	Estimates standard deviation based on a sample, including numbers, text, and logical values
STDEVP	Calculates standard deviation based on the entire population
STDEVPA	Calculates standard deviation based on the entire population, including numbers, text, and logical values
STEYX	Returns the standard error of the predicted y -value for each x in the regression
TDIST	Returns the student's t distribution
TREND	Returns values along a linear trend
TTEST	Returns the probability associated with a student's t test
VAR	Estimates variance based on a sample
VARA	Estimates variance based on a sample, including numbers, text, and logical values
VARP	Calculates variance based on the entire population
VARPA	Calculates variance based on the entire population, including numbers, text, and logical values

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Data di-kelompok-kan

- Data yg dikelompokkan : Syarat utama adalah harus ada Tabel Distribusi Frekuensi
 - Rata-rata.
 - Standar Deviasi.
 - Modus : Median Kelas Modus (MKM) & Tepi Kelas Bawah (TKB)
 - Median : Tepi Kelas Bawah (TKB) & Tepi Kelas Atas (TKA)
 - Quartil : Tepi Kelas Bawah (TKB) & Tepi Kelas Atas (TKA)
 - Desil : Tepi Kelas Bawah (TKB) & Tepi Kelas Atas (TKA)
 - Rata-rata Ukur (Geometric Mean)
 - Rata-rata Harmonis (Harmonic Mean)

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[1] Rata-rata di Kelompokkan

No	Nilai	f_i	md_i	$md_i \cdot f_i$
1	20,00 - 29,99	4	24,995	99,980
2	30,00 - 39,99	9	34,995	314,955
3	40,00 - 49,99	25	44,995	1.124,875
4	50,00 - 59,99	48	54,995	2.639,760
5	60,00 - 69,99	20	64,995	1.299,900
6	70,00 - 79,99	5	74,995	374,975
Jumlah		111		5.854,445

Rata-rata

$$\bar{x} = \frac{\sum md_i \cdot f_i}{n} = 52,743$$

Check :

1. min < rata2 < max [20 < 52.743 < 79]
2. biasanya terdapat pd kelas dg frek. TERBESAR

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[2] Standar Deviasi – di Kelompokkan

No	Nilai	f_i	md_i	$md_i \cdot f_i$	$(md_i - \bar{x})^2 \cdot f_i$
1	20,00 - 29,99	4	24,995	99,980	3.079,750
2	30,00 - 39,99	9	34,995	314,955	2.834,843
3	40,00 - 49,99	25	44,995	1.124,875	1.500,690
4	50,00 - 59,99	48	54,995	2.639,760	243,487
5	60,00 - 69,99	20	64,995	1.299,900	3.002,354
6	70,00 - 79,99	5	74,995	374,975	2.475,814
Jumlah		111		5.854,445	13.136,937

Standar Deviasi

$$s = \sqrt{\frac{\sum (md_i - \bar{x})^2 \cdot f_i}{n}} = 10,879$$

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