Statistik Bisnis | Statistik Deskriptip | STMIK

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.)

Data tidak di-kelompok-kan

- 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

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

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

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

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

$= \frac{60.8}{8} = 7.6$

[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

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

RATA-RATA TIDAK DIKELOMPOKKAN = 36/5 = 7,2

[1.2] Rata-rata Tidak di Kelompokkan

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

Xo tentukan dulu 5

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

Rata-rata x = 7.2

Xo tentukan dulu 7

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

Rata-rata x = 7.2

[1.3] Rata-rata Tidak di Kelompokkan

Rata-rata beberapa periode

$$\bar{x} = \frac{n_1 . \bar{x}_1 + n_2 . \bar{x}_2 + \ldots + n_i . \bar{x}_i}{n_1 + n_2 + \cdots + n_i}$$

BULAN 1	BULAN 2	BULAN 3
7	7	7
5	5	5
7	7	7
8	8	8
9	9	9
	7	9

Jumlah Data per-bulan	5	6	6
Jumlah Per-Bulan	36	43	45
Rata-rata Bulan ke-n	7.200	7.167	7.500

Maka, Rata-rata seluruhnya = 7.294

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

Variance and standard deviation

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

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

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

$$= \frac{(25-36)^2 + (43-36)^2 + (40-36)^2 + (60-36)^2 + (12-36)^2}{4}$$

$$= \frac{(-11)^2 + (7)^2 + (4)^2 + (24)^2 + (-24)^2}{4} = \frac{1338}{4} = 334.5$$

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

[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	(7-7.2)^2
2	**5**	4,84	
3	**7**	0,04	
4	**8**	0,64	
5	**9**	3,24	
Jumlah		**8,80**	

Standar Deviasi yg tidak dikelompokkan :

=SQRT(8,80/5) 1,327

=SQRT(8,80/4) 1,483

- Standar Deviasi = s → Varians = s^2

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.

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

Mode

a. There is no mode because each data value occurs only once.
b. The number −7 is the mode because it is the value that occurs most often. The data set is unimodal.
c. 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.

11

[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
	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		

12

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

Median

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.

Haryoso Wicaksono, S.Si., M.M., M.Kom.

[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 = urutan ke (n+1)/2

m_d = 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 ?

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

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

n genap = 6

Urutan ke (n/2) ≠ (n/2) + 1 ?

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

Haryoso Wicaksono, S.Si., M.M., M.Kom.

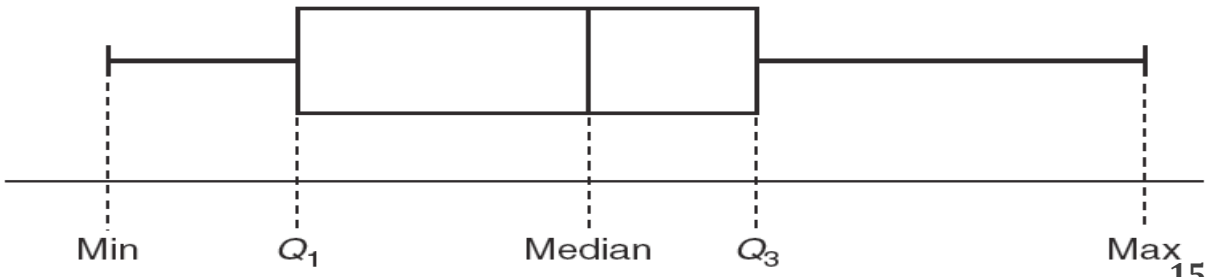
14

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

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)

[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

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

[3.1] Modus di kelompokkan

No	Nilai		f_i
1	20,00	29,99	4
2	30,00	39,99	9
3	40,00	49,99	25
4	50,00	59,99	48
5	60,00	69,99	20
6	70,00	79,99	5
Jumlah			111

LANGKAH :

1. Siapkan Tabel Distribusi Frekuensi
2. Tentukan Kelas Modus, yaitu kelas yang mempunyai frekuensi terbesar

   Kelas Modus ad. Kls ke 4
3. **Ramalan** : Nilai Modus yg dikelompokkan berkisar antara 50,00-59,99.
4. Rumus mengacu pd kls ke 4
5. **2 Cara** : Median Kelas Modus & Tepi Kelas Bawah.
6. **Cek** : keduanya harus sama & terletak pada interval kls #4.

[3.2] Modus di kelompokkan [Md.KM]

3	40,00	49,99	25 f.Sebelum KM
4	50,00	59,99	48 f.KM
5	60,00	69,99	20 f.Sesudah KM

Menggunakan Median dari Kelas Modus (x_o) :

$$mo_{Md.KM} = x_0 + \frac{i}{2} \cdot \frac{f_{ssdhKM} - f_{sblmKM}}{2.f_{KM} - f_{ssdhKM} - f_{sblmKM}}$$

$$= 54{,}995 + \frac{10{,}00}{2} \cdot \frac{20 - 25}{2.48 - 20 - 25} = 54{,}505$$

[3.3] Modus di kelompokkan [Md.TKB]

3	40,00	49,99	25 f.Sebelum KM
4	50,00	59,99	48 f.KM
5	60,00	69,99	20 f.Sesudah KM

Menggunakan Tepi Kelas Bawah dari Kelas Modus (TKB) :

$$mo_{TKB} = TKB + \frac{f_{KM} - f_{sblmKM}}{(f_{KM} - f_{sblmKM}) + (f_{KM} - f_{ssdhKM})} . i$$

$$= 49{,}995 + \frac{48 - 25}{(48 - 25) + (48 - 20)} . 10{,}00 = 54{,}505$$

[4.1] Median dikelompokkan

Median yg Dikelompokkan :

No	Nilai	f_i	Tepi Kelas	f_{kum}	
			19,995	0	
1	20,00 – 29,99	4	29,995	4	
2	30,00 – 39,99	9	39,995	13	
3	40,00 – 49,99	25	49,995	38	
4	50,00 – 59,99	48	59,995	86	55,5
5	60,00 – 69,99	20	69,995	106	
6	70,00 – 79,99	5	79,995	111	
Jumlah		111			

Langkah-2 sbb :

1. Siapkan Tabel Distribusi Frekuensinya
2. Tambahkan kolom Tepi Kelas & Frekuensi Kumulatif
3. Mendefinisikan Kelas Median : kelas dimana terletak urutan data ke n/2. Lihat posisi Frekuensi Kumulatif !
   Kelas Median : kelas ke 4 krn n/2=55,5 terletak antara fkum 38 & 86
   Ramalan : nilai median akan terletak antara 50.00-59.99
4. Median dengan TEPI KELAS BAWAH :

$$md_{TKB} = TKB + \frac{\frac{n}{2} - F_{TKB}}{F_{TKA} - F_{TKB}} . i$$

5. Median dengan TEPI KELAS ATAS :

$$md_{TKA} = TKA - \frac{\frac{n}{2} - (n - F_{TKA})}{F_{TKA} - F_{TKB}} . i$$

6. Periksa 1.nilai median hrs terletak di interval kls median [kls 4]
   2. hasil perhitungan antara 2 cara [TKB&TKA] harus SAMA

[4.2] Median dikelompokkan – TKB & TKA

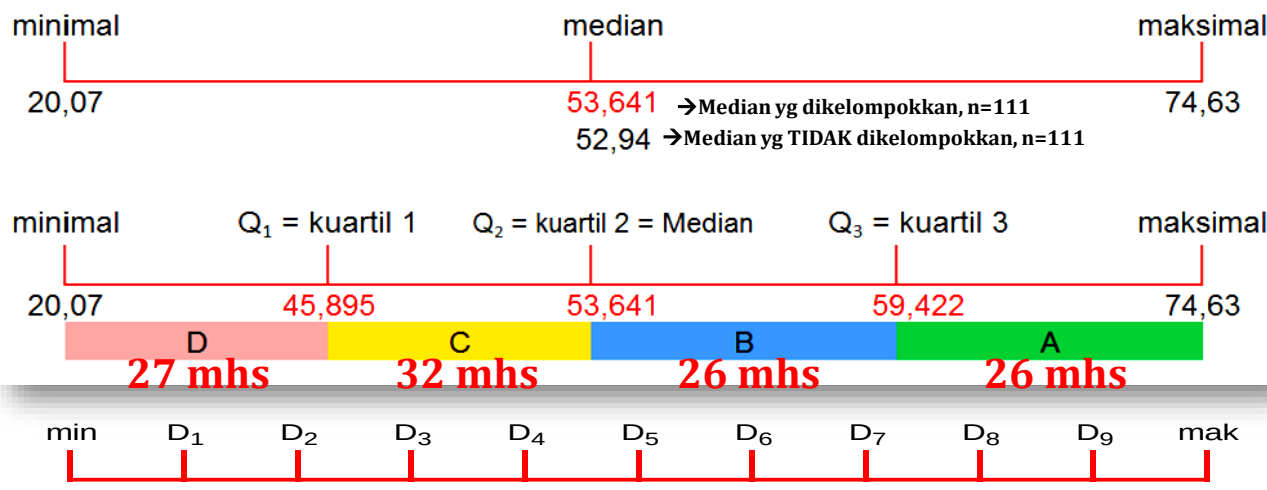
3	40,00 – 49,99	25	TKB 49,995	F.TKB 38	
4	50,00 – 59,99	48			55,5
5	60,00 – 69,99	20	TKA 59,995	F.TKA 86	

$$md_{TKB} = TKB + \frac{\frac{n}{2} - F_{TKB}}{F_{TKA} - F_{TKB}} . i = 49{,}995 + \frac{\frac{111}{2} - 38}{86 - 38} . 10{,}00 = 53{,}641$$

$$md_{TKA} = TKA - \frac{\frac{n}{2} - (n - F_{TKA})}{F_{TKA} - F_{TKB}} . i = 59{,}995 - \frac{\frac{111}{2} - (111 - 86)}{86 - 38} . 10{,}00 = 53{,}641$$

24

Median & Kuartil – Garis Posisi



[5.1] Kuartil 1 = Quartil 1 = Q1

Kuartil 1 [Q1] yg Dikelompokkan :

No	Nilai	f_i	Tepi Kelas	f_{kum}
			19,995	0
1	20,00 – 29,99	4	29,995	4
2	30,00 – 39,99	9	39,995	13
3	40,00 – 49,99	25	49,995	38
4	50,00 – 59,99	48	59,995	86
5	60,00 – 69,99	20	69,995	106
6	70,00 – 79,99	5	79,995	111
Jumlah		111		

27,75

Langkah-2 sbb :

1. Siapkan Tabel Distribusi Frekuensinya
2. Tambahkan kolom Tepi Kelas & Frekuensi Kumulatif
3. Mendefinisikan Kelas **Kuartil 1** : kelas dimana terletak urutan data ke 1/4.n. Lihat posisi Frekuensi Kumulatif ! Kelas Q1 : kelas ke 3 krn 1/4.n=27.75 terletak antara fkum 13 & 38

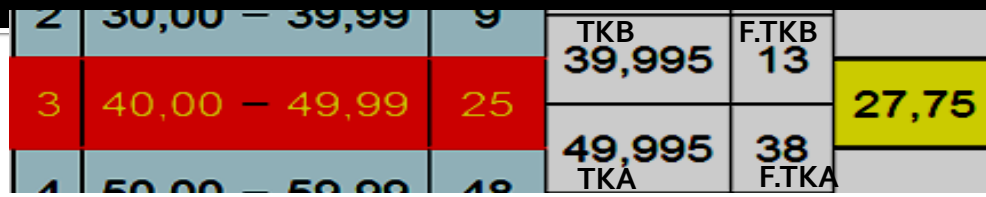
   Ramalan : nilai Kuartil 1 akan terletak antara 40.00-49.99
4. Kuartil 1 Q_1 dengan TEPI KELAS BAWAH :

$$Q_{1TKB} = TKB + \frac{\frac{1}{4}.n - F_{TKB}}{F_{TKA} - F_{TKB}}.i$$

5. Kuartil 1 Q_1 dengan TEPI KELAS ATAS :

$$Q_{1TKA} = TKA - \frac{\frac{1}{4}.n - (2.\frac{1}{4}.n - F_{TKA})}{F_{TKA} - F_{TKB}}.i$$

[5.2] Kuartil 1 = Quartil 1 = Q1



Kuartil 1 Q_1 dengan TEPI KELAS BAWAH :

$$Q_{1.TKB} = TKB + \frac{\frac{1}{4}.n - F_{TKB}}{F_{TKA} - F_{TKB}}.i = 39{,}995 + \frac{\frac{1}{4}.111 - 13}{38 - 13}.10{,}00$$

Kuartil 1 Q_1 dengan TEPI KELAS ATAS :

$$Q_{1.TKA} = TKA - \frac{\frac{1}{4}.n - (2.\frac{1}{4}.n - F_{TKA})}{F_{TKA} - F_{TKB}}.i = 49{,}995 - \frac{\frac{1}{4}.111 - (2.\frac{1}{4}.111 - 38)}{38 - 13}.10{,}00$$

27

[5.3] Kuartil 3 = Quartil 3 = Q3

Kuartil 3 [Q_3] yg Dikelompokkan :

No	Nilai	f_i	Tepi Kelas	f_{kum}	
			19,995	0	
1	20,00 – 29,99	4	29,995	4	
2	30,00 – 39,99	9	39,995	13	
3	40,00 – 49,99	25	49,995	38	
4	50,00 – 59,99	48	59,995	86	83,25
5	60,00 – 69,99	20	69,995	106	
6	70,00 – 79,99	5	79,995	111	
Jumlah		111			

Langkah-2 sbb :

1. Siapkan Tabel Distribusi Frekuensinya
2. Tambahkan kolom Tepi Kelas & Frekuensi Kumulatif
3. Mendefinisikan Kelas **Kuartil 3** : kelas dimana terletak urutan data ke 3/4.n. Lihat posisi Frekuensi Kumulatif ! Kelas Q_3 : kelas ke 4 krn 3/4.n=83.25 terletak antara fkum 38 & 86

   Ramalan : nilai Kuartil 3 akan terletak antara 50.00-59.99
4. Kuartil 3 Q_3 dengan TEPI KELAS BAWAH :

$$Q_{3\,TKB} = TKB + \frac{\frac{3}{4}.n - F_{TKB}}{F_{TKA} - F_{TKB}}.i$$

5. Kuartil 3 Q_3 dengan TEPI KELAS ATAS :

$$Q_{3\,TKA} = TKA - \frac{\frac{3}{4}.n - (2.\frac{3}{4}.n - F_{TKA})}{F_{TKA} - F_{TKB}}.i$$

28

[5.4] Kuartil 3 = Quartil 3 = Q3

			TKB	F.TKB	
3	40,00 – 49,99	25	49,995	38	
4	50,00 – 59,99	48			83,25
5	60,00 – 69,99	20	59,995 TKA	86 F.TKA	

Kuartil 3 Q_3 dengan TEPI KELAS BAWAH :

$$Q_{3.TKB} = TKB + \frac{\frac{3}{4}.n - F_{TKB}}{F_{TKA} - F_{TKB}}.i = 49{,}995 + \frac{\frac{3}{4}.111 - 38}{86 - 38}.10{,}00$$

Kuartil 3 Q_3 dengan TEPI KELAS ATAS :

$$Q_{3.TKA} = TKA - \frac{\frac{3}{4}.n - (2.\frac{3}{4}.n - F_{TKA})}{F_{TKA} - F_{TKB}}.i = 59{,}995 - \frac{\frac{3}{4}.111 - (2.\frac{3}{4}.111 - 86)}{86 - 38}.10{,}00$$

29

Haryoso Wicaksono, S.Si., M.M., M.Kom.

[6.0] Desil = Dn

Desil [D_i] yg Dikelompokkan :

No	Nilai	f_i	Tepi Kelas	f_{kum}	
			19,995	0	
1	20,00 – 29,99	4	29,995	4	
2	30,00 – 39,99	9	39,995	13	
3	40,00 – 49,99	25	49,995	38	
4	50,00 – 59,99	48	59,995	86	44,4
5	60,00 – 69,99	20	69,995	106	
6	70,00 – 79,99	5	79,995	111	
Jumlah		111			

Langkah-2 sbb : Hitunglah D_4

1. Siapkan Tabel Distribusi Frekuensinya
2. Tambahkan kolom Tepi Kelas & Frekuensi Kumulatif
3. Mendefinisikan Kelas **Desil 4** : kelas dimana terletak urutan data ke 4/10.n. Lihat posisi Frekuensi Kumulatif ! Kelas D_4 : kelas ke 4 krn 4/10.n=44,4 terletak antara fkum 38 & 86

   Ramalan : nilai Desil 4 akan terletak antara 50.00-59.99
4. Desil dengan TEPI KELAS BAWAH :

$$D_{x\ TKB} = TKB + \frac{\frac{x}{10}.n - F_{TKB}}{F_{TKA} - F_{TKB}}.i$$

5. Desil dengan TEPI KELAS ATAS :

$$D_{x\ TKA} = TKA - \frac{\frac{x}{10}.n - (2.\frac{x}{10}.n - F_{TKA})}{F_{TKA} - F_{TKB}}.i$$

x = desil ke sekian. D4 --> x = 4

30

Haryoso Wicaksono, S.Si., M.M., M.Kom.

[6.1] Desil = Dn → D4

3	40,00 – 49,99	25			
4	50,00 – 59,99	48	49,995	38	44,4
			59,995	86	
5	60,00 – 69,99	20			

$$D_{4.TKB} = TKB + \frac{\frac{4}{10}.n - F_{TKB}}{F_{TKA} - F_{TKB}}.i = 49{,}995 + \frac{\frac{4}{10}.111 - 38}{86 - 38}.10{,}00$$

$$D_{4.TKA} = TKA - \frac{\frac{4}{10}.n - (2.\frac{4}{10}.n - F_{TKA})}{F_{TKA} - F_{TKB}}.i = 59{,}995 - \frac{\frac{4}{10}.111 - (2.\frac{4}{10}.111 - 86)}{86 - 38}.10{,}00$$

[7.1] Rata-rata Ukur [Geometric Mean]

- Rata-rata ukur dari rasio/perbandingan X1, X2, ... , Xn adalah :

$$G_m = [X_1.X_2.\ldots.X_n]^{1/n} = \sqrt[n]{[X_1.X_2.\ldots.X_n]}$$

- Untuk mengukur tingkat perubahan (rate of change) atau pe-rata-rata-an rasio.
- Mis. Jumlah pinjaman saya selama 3 periode adalah Rp. 400.000,- ; Rp. 650.000,- & Rp. 1.000.000,-. Berapakah tingkat pertumbuh-an/penambahan rata-rata dari pinjaman tsb pada tiap periodenya ?

[7.2] Rata-rata Ukur [Geometric Mean]

$$400.000 \rightarrow 650.000 \rightarrow rasio = \frac{650.000}{400.000} = 1{,}625 \rightarrow X_1$$

$$650.000 \rightarrow 1.000.000 \rightarrow rasio = \frac{1.000.000}{650.000} = 1{,}538 \rightarrow X_2$$

Rata-rata Ukur Geometrik : Menghitung rata-rata perubahan data

Data ke-n	Pinjaman ke-n	Rasio Data	
1	400.000	1,625	650.000/400.000
2	650.000	1,538	1.000.000/650.000
3	1.000.000		

Maka, Gm = 1,581 — rata-rata kenaikan 58,11%

MS Excel : =GEOMEAN(D14:D15) — rata-rata perubahan 158,11%

1,581

$$Maka, G_m = \sqrt[2]{[\,1{,}625\ .\ 1{,}538]} = 1{,}581$$

[7.3] Rata-rata Ukur [Geometric Mean]

$$G_m = [X_1 . X_2 . \ldots . X_n]^{1/n} = \sqrt[n]{[X_1 . X_2 . \ldots . X_n]}$$

Bila hanya periode pertama (X_0) & terakhir (X_n) maka :

$$Maka, G_m = \sqrt[n]{\frac{X_n}{X_0}} = \sqrt[2]{[\frac{1.000.000}{400.000}]} = 1{,}581$$

- Rata-rata Ukur sbg pengukuran tingkat pertumbuhan (rate of growth) dapat menggunakan rumus bunga :

$$P_n = P_0 . (1 + r)^n$$

n = Periode waktu

Pn = Jumlah uang pd akhir periode n

P0 = Jumlah pokok yg akan dibungakan

r = Tingkat bunga

[7.4] Rata-rata Ukur [Geometric Mean]

- Terapannya untuk menghitung pertumbuhan penduduk. Mis. Penduduk Indonesia th 1971 = 119.208.229 & th 1980 = 147.490.298. Berapa tingkat pertumbuhannya per tahun ? 255 juta tahun 2016. Tahun 2010 : 245juta.

$$r = \sqrt[n]{\frac{P_n}{P_0}} - 1 = \sqrt[9]{\frac{147.490.298}{119.208.229}} - 1 = \sqrt[9]{1{,}237249} - 1$$

$$= 1{,}023936 - 1 = 0{,}023936 = 2{,}39\%$$

- MS Excel : =(POWER(1,237249;1/9)-1)*100

[8.1] Rata-rata Harmonis [Harmonic Mean]

- Bila distribusi memiliki nilai-nilai observasi yg positif X1, X2, ..., Xn sejumlah n, maka rata-rata harmonisnya :

$$r_h = \frac{n}{\sum \frac{1}{X_n}}$$

- Mis. Ada 3 petugas diminta membeli benih Jagung, sbb.

  Petugas A membeli benih jagung dg harga Rp. 30.000,-/kg
  Petugas B membeli benih jagung dg harga Rp. 10.000,-/kg
  Petugas C membeli benih jagung dg harga Rp. 5.000,-/kg
  Setiap petugas mendapatkan anggaran masing-2 Rp. 450.000.000

- Berapakah harga rata-rata benih Jagung per-kg yg dibayarkan ?

$$r_h = \frac{n}{\sum \frac{1}{X_n}} = \frac{3}{\frac{1}{30.000} + \frac{1}{10.000} + \frac{1}{5.000}} = \frac{3}{\frac{1+3+6}{30.000}} = \frac{3 \times 30.000}{10} = 9.000$$

[8.2] Rata-rata Harmonis [Harmonic Mean]

$$r_h = \frac{n}{\sum \frac{1}{X_n}} = \frac{3}{\frac{1}{30.000} + \frac{1}{10.000} + \frac{1}{5.000}} = \frac{3}{\frac{1+3+6}{30.000}} = \frac{3 \times 30.000}{10} = 9.000$$

Rata-rata Harmonis = Rata-rata Harga Satuan

Nama Petugas	Dana Rp	H.Sat. Rp/kg	Barang kg
Petugas A	450.000.000	30.000	15.000
Petugas B	450.000.000	10.000	45.000
Petugas C	450.000.000	5.000	90.000
	1.350.000.000		150.000

Harga Rata-rata Benih Jagung = Jumlah uang / jumlah barang =

=1.350.000.000 / 150.000 = 9.000

MS Excel : =HARMEAN(30000;10000;5000) 9.000

Sekian