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63	70	78	81	85	67	88
73	78	77	78	75	74	77

76

Dispersion Measurements

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:

Rang المدى ١/٢/٤

المدى في حالة البيانات غير المبوبة = أكبر قراءة - أقل قراءة
 $Rang = Max - Min$

(٤-١)

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المدى في حالة البيانات الميوبة = مركز الفئة الأخيرة - مركز الفئة الأولى (٤-٢)

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9

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4.8 6.21 5.4 5.18 5.29 5.18 5.08 4.63 5.03

- =

4.63 = 6.21 =

:

$$\text{Rang} = \text{Max} - \text{Min} = 6.21 - 4.63 = 1.58$$

. / 1.58

(-)

60

	15-20	20-25	25-30	30-35	35-40	40-45
	3	9	15	18	12	3

- =

$$(15+20)/2=35/2=17.5 :$$

$$(40+45)/2=85/2=42.5 :$$

$$\text{Rang} = 42.5 - 17.5 = 25$$

25

∩∩

-1

-2

-3

-

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Quartile Deviation (Q)

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(Q)

$$Q = \frac{Q_3 - Q_1}{2}$$

(3-1)

Q₃

Q₁

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=

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(-)

	4.63	4.8	5.03	5.08	5.18	5.18	5.29	5.4	6.21
	1	2	3	4	5	6	7	8	9

Q₁

∇Λ

$$(n+1)\left(\frac{1}{4}\right) = (9+1)(0.25) = 2.5 \quad :$$

$$x_{(l)} = x_{(2)} = 4.8, \quad x_{(u)} = x_{(3)} = 5.03, \quad R = 2.5, \quad l = 2, \quad R - l = 0.5$$

$$\begin{aligned} Q_1 &= x_{(l)} + (r-l)(x_{(u)} - x_{(l)}) \\ &= 4.8 + 0.5(5.03 - 4.8) = 4.915 \end{aligned}$$

(Q₃)

$$(n+1)\left(\frac{3}{4}\right) = (9+1)(0.75) = 7.5 \quad :$$

$$x_{(l)} = x_{(7)} = 5.29, \quad x_{(u)} = x_{(8)} = 5.4, \quad R = 7.5, \quad l = 7, \quad R - l = 0.5$$

$$\begin{aligned} Q_3 &= x_{(l)} + (R-l)(x_{(u)} - x_{(l)}) \\ &= 5.29 + 0.5(5.4 - 5.29) = 5.345 \end{aligned}$$

$$Q = \frac{Q_3 - Q_1}{2} = \frac{5.345 - 4.915}{2} = 0.215$$

l 0.215

(-)

(-)

:

(Q₁)

$$n(1/4) = 60(0.25) = 15 \quad :$$

$$f = 15, \quad f_1 = 12, \quad f_2 = 27, \quad A = 25, \quad L = 5$$

$$Q_1 = A + \frac{f - f_1}{f_2 - f_1} L$$

$$= 25 + \frac{15 - 12}{27 - 12} (5) = 25 + \frac{3}{15} (5) = 26$$

حدود المساحة	عدد المزارع	أقل من	تكرار متجمع
15-	3	15	0
20-	9	20	3
25-	15	A 25	f_1 12
30-	18	30	f_2 27 (15)
35-	12	A 35	45 (45)
40-45	3	40	57
sum	60	45	60

(Q₃)

$$n(3/4) = 60(0.75) = 45 \quad :$$

$$f = 45, f_1 = 45, f_2 = 57, A = 35, L = 5$$

$$Q_3 = A + \frac{f - f_1}{f_2 - f_1} L$$

$$= 35 + \frac{45 - 45}{57 - 45} (5) = 35 + \frac{(0)}{15} (5) = 35$$

$$Q = \frac{Q_3 - Q_1}{2} = \frac{35 - 26}{2} = 4.5$$

Mean Deviation (MD)

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Λ.

($\bar{x} = \sum x/n$) x_1, x_2, \dots, x_n

(MD)

$$MD = \frac{\sum |x - \bar{x}|}{n}$$

(t-t)

4 5 2 10 7

(-)

$$\bar{x} = \frac{\sum x}{n} = \frac{28}{5} = 5.6$$

x	$(x - \bar{x}) = (x - 5.6)$	$ x - 5.6 $
4	$4 - 5.6 = -1.6$	1.6
5	$5 - 5.6 = -0.6$	0.6
2	$2 - 5.6 = -3.6$	3.6
10	$10 - 5.6 = 4.4$	4.4
7	$7 - 5.6 = 1.4$	1.4
Sum	0	11.6

$$MD = \frac{\sum |x - \bar{x}|}{n} = \frac{11.6}{5} = 2.32 (\quad)$$

Λ 1

$$MD = \frac{\sum |x - \bar{x}| f}{n}$$

(0-4)

\bar{x}

x

f

(-)

40

	2 - 5	5 - 8	8 - 11	11 - 14	14 - 17
	1	8	13	10	8

(-)

:

	f	x	$x f$	\bar{x}	$ x - \bar{x} $	$ x - \bar{x} f$
2-5	1	3.5	3.5	$\bar{x} = \frac{\sum x}{n}$ $= \frac{428}{40} = 10.7$	7.2	7.2
5-8	8	6.5	52		4.2	33.6
8-11	13	9.5	123.5		1.2	15.6
11-14	10	12.5	125		1.8	18
14-17	8	15.5	124		4.8	38.4
sum	40		428			112.8

:

$$MD = \frac{\sum |x - \bar{x}| f}{n} = \frac{112.8}{40} = 2.82$$

2.82

:

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•

Λϣ

Variance //

(σ²) :

x₁, x₂, ..., x_N:

()σ²

$$\sigma^2 = \frac{\sum (x - \mu)^2}{N}$$

(7-4)

μ = Σx/N:

μ

(-)

15

5 13 7 14 12 9 6 8 10 13 14 6 11 12 10

(-)

μ

$$\mu = \frac{1}{N} \sum x$$

$$= \frac{1}{15} (5 + 13 + 7 + \dots + 12 + 10) = \frac{1}{15} (150) = 10$$

$$\sum (x - \mu)^2$$

$$\sum (x - \mu)^2 = 130$$

:

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$$\sigma^2 = \frac{\sum(x-\mu)^2}{N} = \frac{130}{15} = 8.67$$

x	$(x-\mu)$	$(x-\mu)^2$
5	5-10 = -5	25
13	3	9
7	-3	9
14	4	16
12	2	4
9	-1	1
6	-4	16
8	-2	4
10	0	0
13	3	9
14	4	16
6	-4	16
11	1	1
12	2	4
10	0	0
150	0	130

: (-)

: $\sum(x-\mu)^2$

$$\begin{aligned} \sum(x-\mu)^2 &= \sum(x^2 - 2x\mu + \mu^2) \\ &= \sum x^2 - 2\mu\sum x + \sum \mu^2 \\ &= \sum x^2 - 2N\mu^2 + N\mu^2 \\ &= \sum x^2 - N\mu^2 \end{aligned}$$

:

$$\sigma^2 = \frac{\sum x^2 - N\mu^2}{N} = \frac{1}{N} \sum x^2 - \mu^2$$

Λξ

$$\sigma^2 = \frac{1}{N} \sum x^2 - \mu^2$$

(V-4)

: $\sum x$, $\sum x^2$: (-)

x	x^2
5	25
13	169
7	49
14	196
12	144
9	81
6	36
8	64
10	100
13	169
14	196
6	36
11	121
12	144
10	100
150	1630

$$\sum x = 150 \text{ , } \sum x^2 = 1630$$

$$\mu = \frac{1}{N} \sum x = \frac{1}{15}(150) = 10$$

$$\begin{aligned} \sigma^2 &= \frac{1}{N} \sum x^2 - \mu^2 \\ &= \frac{1}{15} 1630 - 10^2 = 108.67 - 100 = 8.67 \end{aligned}$$

. (-)

(s²)

:

σ^2

n

: s²

x_1, x_2, \dots, x_n

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

(A-4)

$$\bar{x} = \sum x / n :$$

\bar{x}

(-)

10

5 (-) (-)

8 13 10 5 9

: (-)

$$\bar{x} = \frac{1}{n} \sum x = \frac{1}{5} (8+13+10+5+9) = \frac{1}{5} (45) = 9$$

$$\sum (x - \bar{x})^2$$

x	8	13	10	5	9	45
$(x - \bar{x})$	-1	4	1	-4	0	0
$(x - \bar{x})^2$	1	16	1	16	0	34

$$\sum (x - \bar{x})^2 = 34$$

$$s^2 = \frac{\sum (x - \bar{x})^2}{n - 1} = \frac{34}{(5 - 1)} = \frac{34}{4} = 8.5$$

(-)

$$: \sum (x - \bar{x})^2$$

$$\begin{aligned} \sum (x - \bar{x})^2 &= \sum (x^2 - 2x\bar{x} + \bar{x}^2) \\ &= \sum x^2 - 2\bar{x}\sum x + \sum \bar{x}^2 \\ &= \sum x^2 - 2n\bar{x}^2 + n\bar{x}^2 \\ &= \sum x^2 - n\bar{x}^2 \end{aligned}$$

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

$$\boxed{s^2 = \frac{1}{n-1} \left(\sum x^2 - n\bar{x}^2 \right)} \quad (9-t)$$

: (-)

$$\boxed{s^2 = \frac{1}{n-1} \left(\sum x^2 - \frac{(\sum x)^2}{n} \right)} \quad (10-t)$$

:

x	8	13	10	5	9	45
x^2	64	169	100	25	81	439

: (-)

$$\begin{aligned} s^2 &= \frac{1}{n-1} \left(\sum x^2 - n\bar{x}^2 \right) \\ &= \frac{1}{5-1} \left(439 - 5(9)^2 \right) = \frac{1}{4} (34) = 8.5 \end{aligned}$$

: (-)

$$s^2 = \frac{1}{n-1} \left(\sum x^2 - \frac{(\sum x)^2}{n} \right)$$

$$= \frac{1}{5-1} \left(439 - \frac{(45)^2}{5} \right) = \frac{1}{4} (439 - 405) = \frac{1}{4} (34) = 8.5$$

Standard Deviation

" 8.5 " 8.5

:

$$\boxed{\text{التباين} = \text{الانحراف المعياري}} \quad (11-4)$$

:

() (-) •
: (σ)

$$\sigma = \sqrt{\frac{1}{N} \sum x^2 - \mu^2}$$

$$= \sqrt{\frac{1}{15} 1630 - 10^2} = \sqrt{8.67} = 2.94$$

. 2.94

: s (-) •

$$\begin{aligned}
 s &= \sqrt{\frac{1}{n-1} \left(\sum x^2 - \frac{(\sum x)^2}{n} \right)} \\
 &= \sqrt{\frac{1}{5-1} \left(439 - \frac{(45)^2}{5} \right)} = \sqrt{\frac{1}{4} (439 - 405)} = \sqrt{\frac{1}{4} (34)} = 2.92
 \end{aligned}$$

$$\begin{aligned}
 s &= \sqrt{\frac{\sum (x - \bar{x})^2 f}{n-1}} \\
 \text{or} \\
 s &= \sqrt{\frac{\sum x^2 f - \frac{(\sum xf)^2}{n}}{n-1}}
 \end{aligned}$$

(12-4)

$$\begin{array}{cccc}
 n & (\sum xf/n) & \bar{x} & x & f \\
 & \cdot (s^2) & & & (n = \sum f)
 \end{array}$$

(-)

(-)

(-)

· $\sum xf$, $\sum x^2 f$:

	f	x	xf	$x^2 f$
2-5	1	3.5	3.5	12.25
5-8	8	6.5	52	338
8-11	13	9.5	123.5	1173.25
11-14	10	12.5	125	1562.5
14-17	8	15.5	124	1922
sum	40		428	5008

$$n = \sum f = 40$$

$$\sum xf = 428$$

$$\sum x^2 f = 5008$$

:

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

$$= \sqrt{\frac{5008 - \frac{(428)^2}{40}}{40 - 1}} = \sqrt{\frac{5008 - 4579.6}{39}}$$

$$= \sqrt{10.984615} = 3.314$$

3.314

. (2.88)

:

:

s_x

$s_x = 0$:

a

$x: a, a, a, \dots, a$

. x

:

()

()

9.

$$: s_y = s_x : \quad (y = x + a) : x_1 + a, x_2 + a, \dots, x_n + a : \quad (-)$$

5

0.5

. 1, 1.75, 2, 1.25, 2.5 :

-1

-2

-

x	x^2
1	1
1.75	3.0625
2	4
1.25	1.5625
2.5	6.25
8.5	15.875

$$n = 5$$

$$\sum x = 8.5$$

$$\sum x^2 = 15.875$$

:

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

$$= \sqrt{\frac{15.875 - \frac{(8.5)^2}{5}}{5}} = \sqrt{\frac{15.875 - 14.45}{5}} = 0.534$$

$$= \sqrt{10.984615} = 3.314$$

-

0.5

91

$$y = x + 0.5 :$$

:

$$s_y = s_x = 0.534$$

0.534

: •

x

$$s_y = a s_x :$$

a

$$y = ax :$$

4

100

50

2

$$y = 2x$$

$$s_y = 2s_x = 2(4) = 8$$

8

: y

$$y = ax + b :$$

: •

5

$$s_y = a s_x$$

:

$$y = 2x + 5 :$$

100

$$y = 2x + 5$$

$$s_y = 2s_x = 2(4) = 8$$

-
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