Pelatihan *STaTiSTiK* untuk LaboRatorium

(RcChem/11-13 April 2016)

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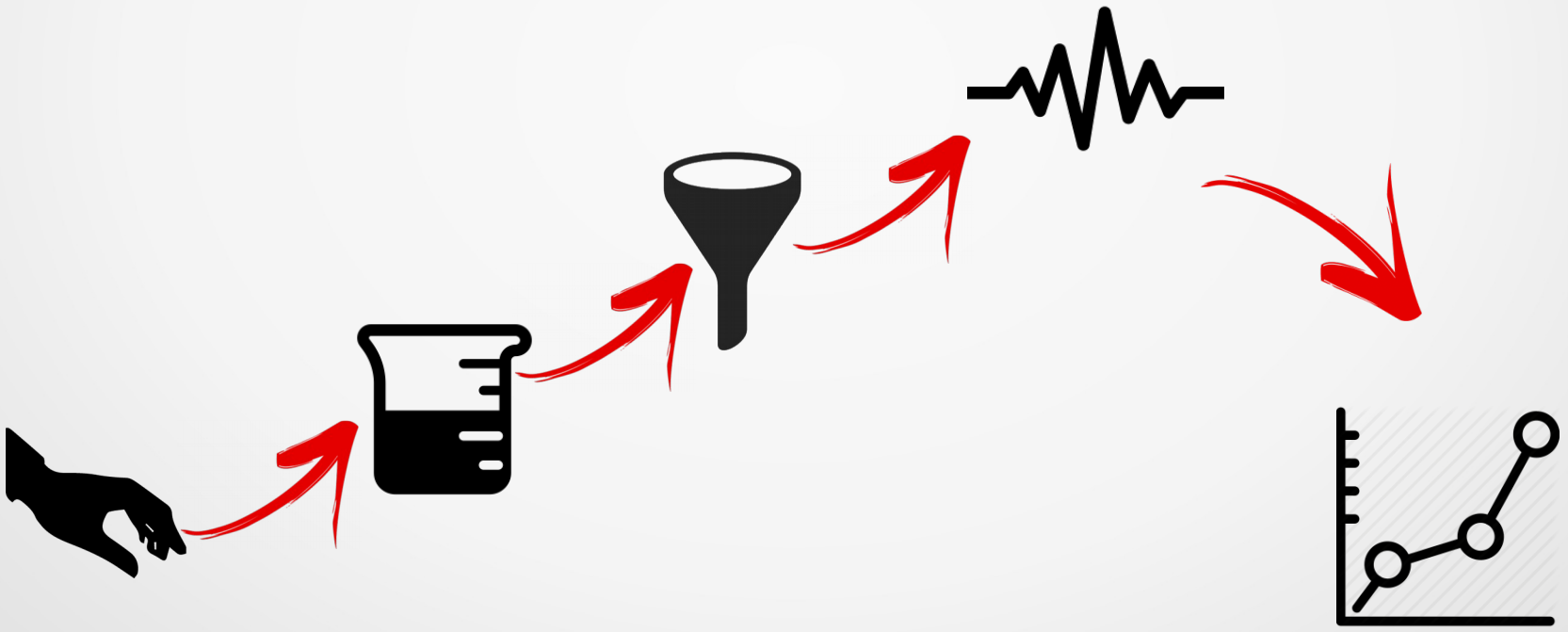
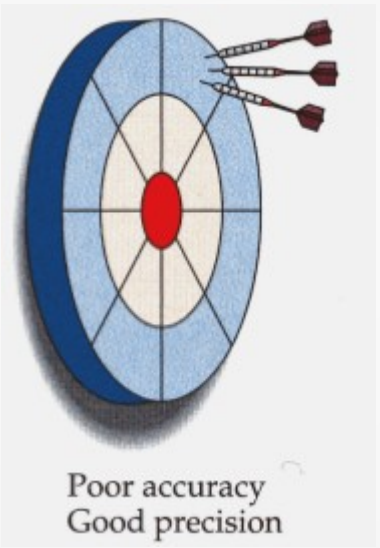
masalah analis

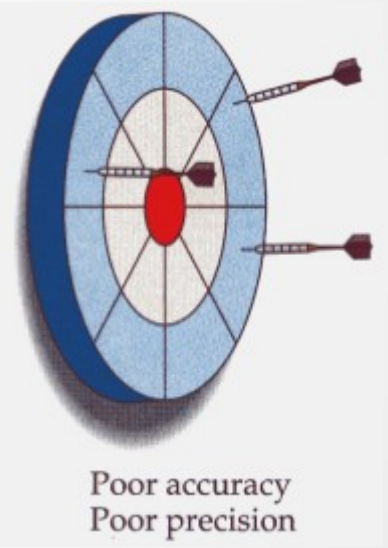


Presisi & AKURASI

Good accuracy
Good precision

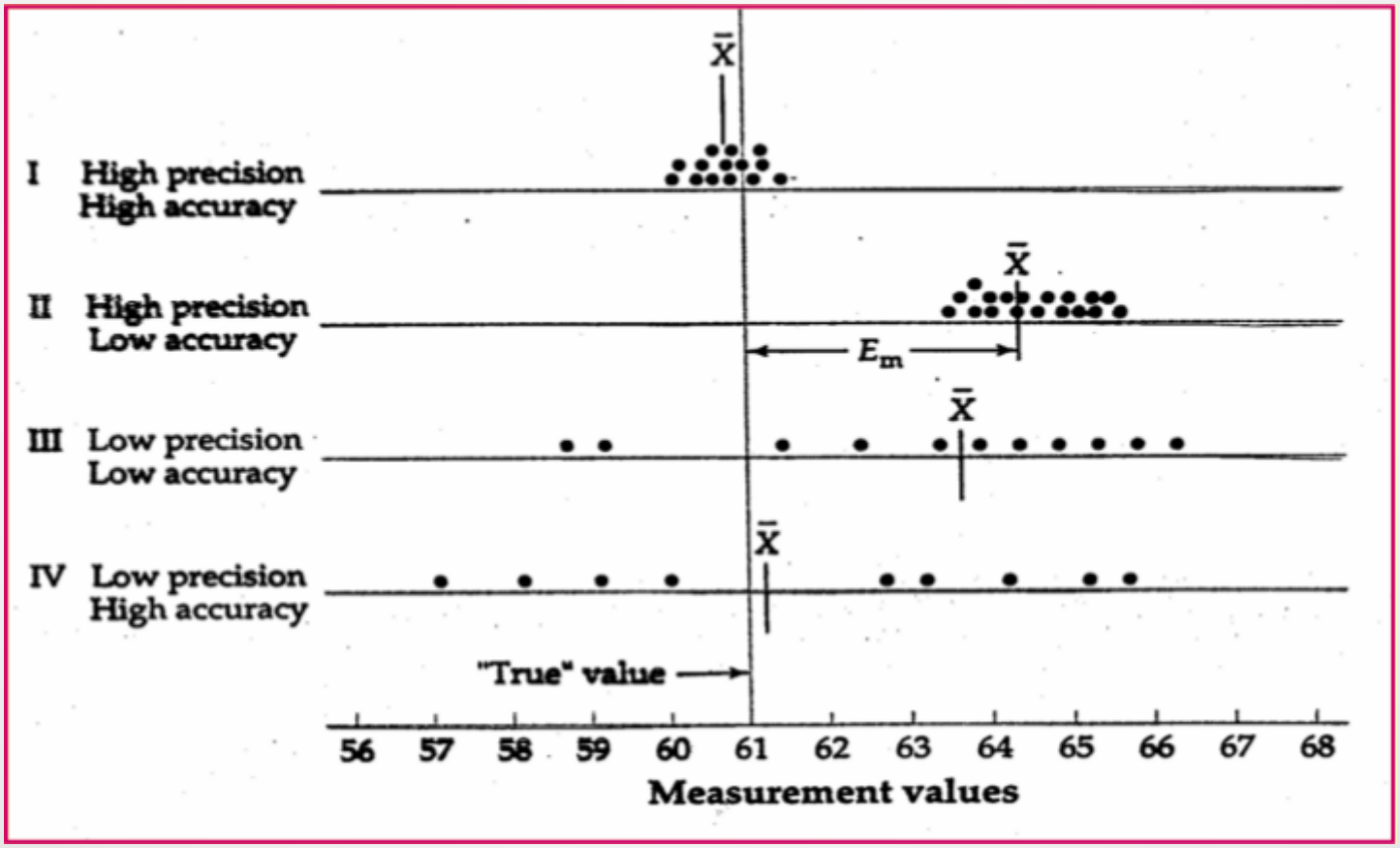


Poor accuracy
Good precision

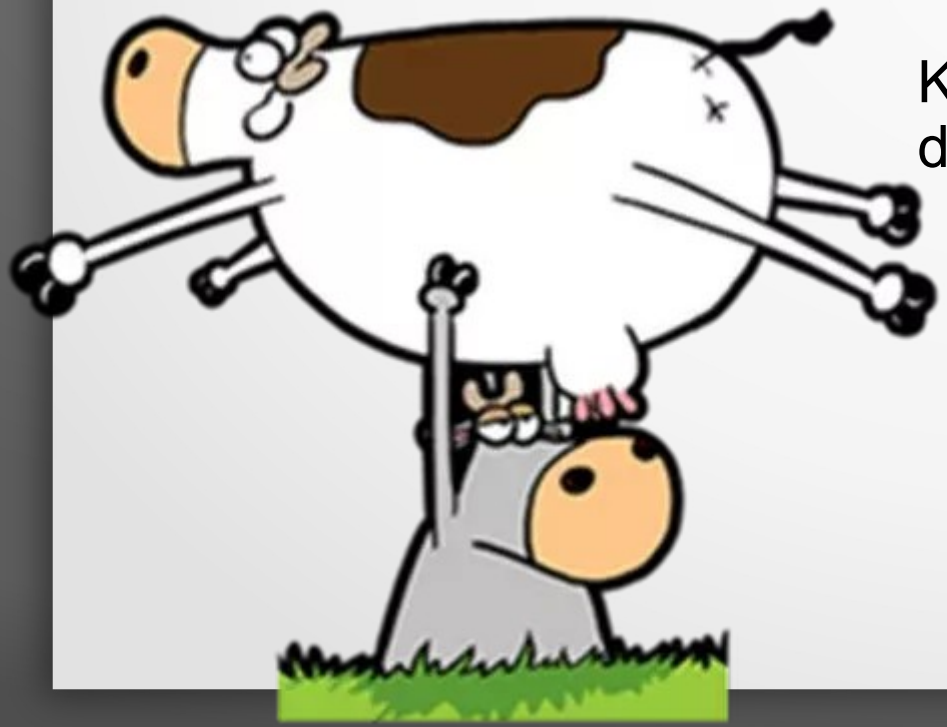


Poor accuracy
Poor precision

Presisi & AKURASI



Presisi & AKURASI



Makin banyak dilakukan pengukuran, kita akan makin yakin bahwa nilai rata-rata mendekati nilai “benar”.

Ketidakpastian berkurang sebanding dengan $1/\sqrt{n}$

INTERVAL keyakinan

Penetapan kandungan merkuri dalam contoh ikan adalah sebagai berikut: 1.80, 1.58, 1.64, 1.49 ppm Hg. Hitung interval keyakinan 50% dan 90% untuk kadar merkuri dalam ikan.

Find $\bar{x} = 1.63$

$s = 0.131$

50% interval keyakinan

t = 0.765 for n-1 = 3

$$\mu = \bar{x} \pm \frac{ts}{\sqrt{n}} \longrightarrow \mu = 1.63 \pm \frac{(0.765)(0.131)}{\sqrt{4}}$$

$$\mu = 1.63 \pm 0.05$$

Terdapat 50% kemungkinan bahwa nilai benar rata-rata terletak antara 1.58 dan 1.68 ppm

INTERVAL keyakinan

$\bar{x} = 1.63$

$s = 0.131$

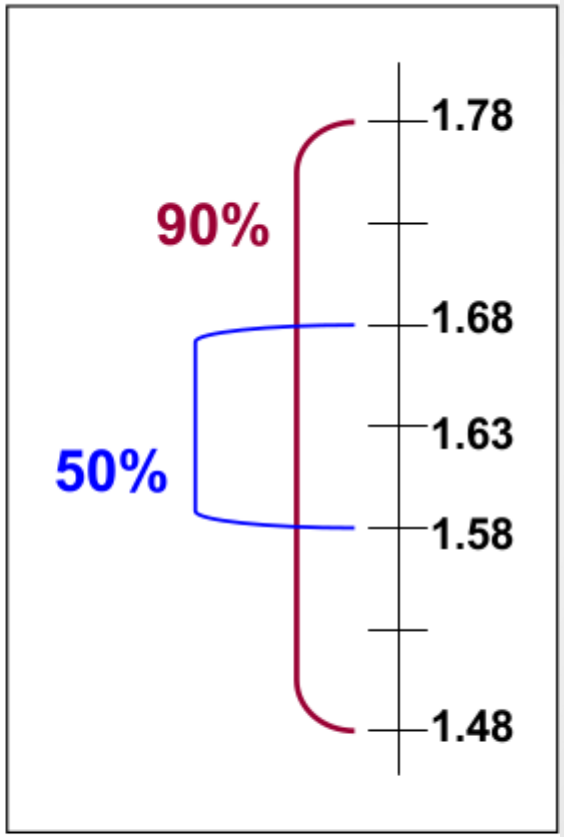
90% interval keyakinan:

t = 2.353 for n-1 = 3

$$\mu = \bar{x} \pm \frac{ts}{\sqrt{n}}$$

$$\mu = 1.63 \pm \frac{(2.353)(0.131)}{\sqrt{4}}$$

$$\mu = 1.63 \pm 0.15$$



Terdapat 90% kemungkinan bahwa nilai benar rata-rata terletak antara 1.48 dan 1.78 ppm

INTERVAL keyakinan

$x = 1.63$

$s = 0.131$

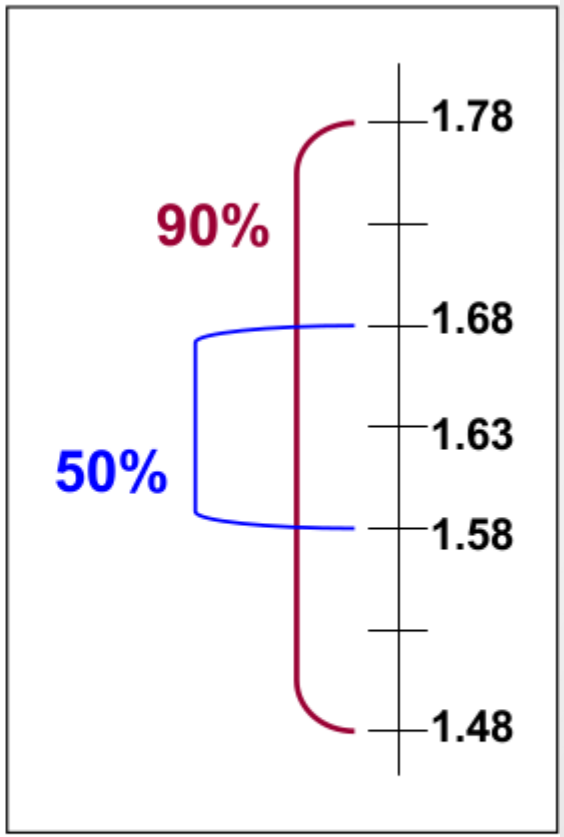
90% interval keyakinan:

t = 2.353 for n-1 = 3

$$\mu = \bar{x} \pm \frac{ts}{\sqrt{n}}$$

$$\mu = 1.63 \pm \frac{(2.353)(0.131)}{\sqrt{4}}$$

$$\mu = 1.63 \pm 0.15$$



Terdapat 90% kemungkinan bahwa nilai benar rata-rata terletak antara 1.48 dan 1.78 ppm

Seleksi DATA (Uji Dixon/Grubbs)

- Pertama-tama data harus diurut dari kecil ke besar (x1 , x2 , ...xn)
- Nilai D atau G hasil perhitungan (menurut rumusnya masing-masing) dibandingkan dengan Nilai D atau G kritis yang ada pada Tabel Dixon/Grubbs
- Apabila nilai D/G hitung lebih besar dari nilai D/G tabel, maka data dibuang (outlier)

Seleksi DATA (Uji Dixon)

Hasil Analisis Sulfat dalam Air (Diurut)

Kode Lab	Hasil analisis (ppm)	
C	0.0	X1
O	58.3	X2
L	97.3	X3
I	99.1	X4
J	99.4	
H	99.5	
K	99.8	
E	104.0	
N	104.0	
M	105.0	
B	105.5	
G	105.6	
D	114.0	Xn-2
F	130.0	Xn-1
A	156.0	Xn

n = 15

Terendah → $D_{13\text{-}40} = \dfrac{X_3 - X_1}{X_{n-2} - X_1}$

$$D = \frac{(97.3 - 0.0)}{(114.0 - 0.0)} = 0.85$$

$D_{\text{tabel n = 15}} = 0.565$
Data dr Lab C dibuang

Tertinggi → $D_{13\text{-}40} = \dfrac{X_n - X_{n-2}}{X_n - X_3}$

$$D = \frac{(156 - 114)}{(156 - 97.3)} = 0.72$$

$D_{\text{tabel n = 15}} = 0.565$
Data dr Lab A dibuang

Seleksi DATA (Uji Dixon)

Lab A and C outlier

Kode Lab	Hasil analisis (ppm)	
O	58.3	X1
L	97.3	X2
I	99.1	X3
J	99.4	
H	99.5	
K	99.8	
E	104.0	
N	104.0	
M	105.0	
B	105.5	
G	105.6	Xn-2
D	114.0	Xn-1
F	130.0	Xn

n = 13

Terendah → $D_{13\text{-}40} = \dfrac{X_3 - X_1}{X_{n-2} - X_1}$

$$D = \frac{(99.1 - 58.3)}{(105.6 - 58.3)} = 0.86$$

$D_{\text{tabel n = 13}} = 0.611$

Data dr Lab O dibuang

Tertinggi → $D_{13\text{-}40} = \dfrac{X_n - X_{n-2}}{X_n - X_3}$

$$D = \frac{(130 - 105.6)}{(130 - 99.1)} = 0.79$$

$D_{\text{tabel n = 13}} = 0.611$

Data dr Lab F dibuang

Seleksi DATA (Uji Dixon)

Lab A, C, O dan F outlier

n = 11

Kode Lab	Hasil analisis (ppm)	
L	97.3	X1
I	99.1	X2
J	99.4	X3
H	99.5	
K	99.8	
E	104.0	
N	104.0	
M	105.0	
B	105.5	Xn-2
G	105.6	Xn-1
D	114.0	Xn

Terendah → $D_{8\text{-}12} = \dfrac{X_2 - X_1}{X_{n-1} - X_1}$

$$D = \frac{(99.1 - 97.3)}{(105.6 - 97.3)} = 0.22$$

$D_{\text{tabel n = 11}} = 0.502$

Data dr Lab L tidak dibuang

Tertinggi → $D_{8\text{-}12} = \dfrac{X_n - X_{n-1}}{X_n - X_2}$

$$D = \frac{(114 - 105.6)}{(114 - 99.1)} = 0.59$$

$D_{\text{tebel n = 11}} = 0.502$

Data dr Lab D dibuang

Seleksi DATA (Uji Dixon)

Lab A, C, O, F dan D outlier

n = 10

Kode Lab	Hasil analisis (ppm)	
L	97.3	X1
I	99.1	X2
J	99.4	X3
H	99.5	
K	99.8	
E	104.0	
N	104.0	
M	105.0	
B	105.5	Xn-1
G	105.6	Xn

Terendah → $D_{8\text{-}12} = \dfrac{X_2 - X_1}{X_{n-1} - X_1}$

$$D = \frac{(99.1 - 97.3)}{(105.5 - 97.3)} = 0.22$$

$D_{\text{tabel n = 10}} = 0.53$

Data dr Lab L tidak dibuang

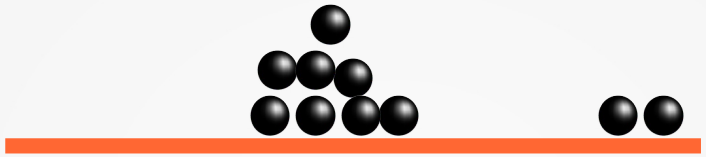
Tertinggi → $D_{8\text{-}12} = \dfrac{X_n - X_{n-1}}{X_n - X_2}$

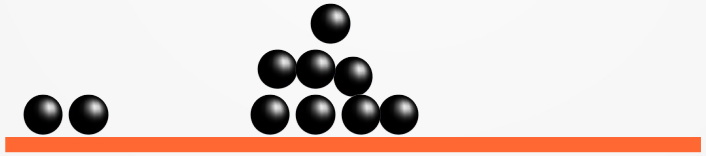
$$D = \frac{(105.6 - 105.5)}{(105.6 - 99.1)} = 0.02$$

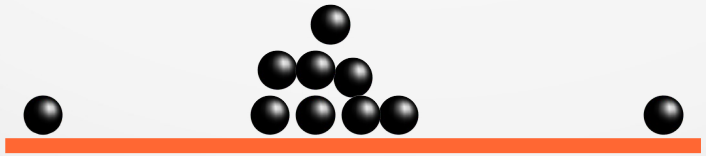
$D_{\text{tabel n = 10}} = 0.53$

Data dr Lab G tidak dibuang

Seleksi DATA (Kelemahan Uji Dixon)







Seleksi DATA (Uji Grubbs)

Uji Grubbs

$$G_{1\ (terendah/\ tertinggi)} = \frac{|\bar{x} - x_i|}{s}$$

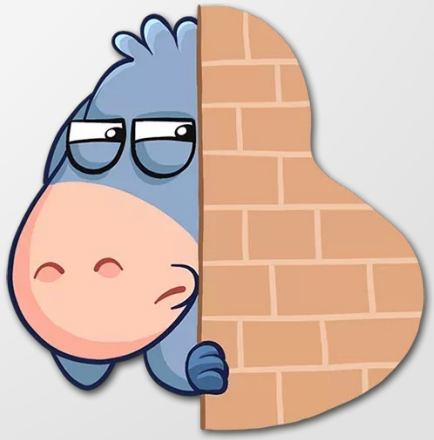
$$G_2 = \frac{X_n - X_1}{s}$$

s = SD dari semua hasil
X = x rata-rata
X_i = data yang diuji
X_n = data tertinggi
X_1 = data terendah

$$G_{3\ pasangan\ rendah} = 1 - [(n - 3)\ s^2_{n-2} / (n-1)\ s^2]$$

$$G_{3\ pasangan\ tinggi} = 1 - [(n - 3)\ s^2_{n-2} / (n-1)\ s^2]$$

s_{n-2} = standar deviasi tanpa menyertakan 2 data terendah atau 2 data tertinggi



Seleksi DATA (Uji Grubbs)

2,0 2,1 2,2 2,3 2,3 2,9 3,1

$$D_{3\text{-}7} = \frac{X_n - X_{n-1}}{X_n - X_1}$$

D = (3,1-2,9)/ (3,1-2)

= 0,18

< 0,569 ($D_{tabel\ n=7}$)

Data 3,1 tidak dibuang (bukan outlier)

Seleksi DATA (Uji Grubbs)

$G_{3\ \text{pasangan tinggi}} = 1 - [(n-3)\, s^2_{n-2} / (n-1)\, s^2]$

2,0 2,1 2,2 2,3 2,3 2,9 3,1

$s^2_{n-2} = 0{,}017 \qquad s^2 = 0{,}175$

$G_{3\ \text{pasangan tinggi}} = 1-[(7-3)0{,}017/(7-1)0{,}175] = 0{,}94$

$> 0{,}8980\ (G_{3\ \text{tabel n=7}})$

2,9 dan 3,1 dibuang (outlier)

Kontrol sample

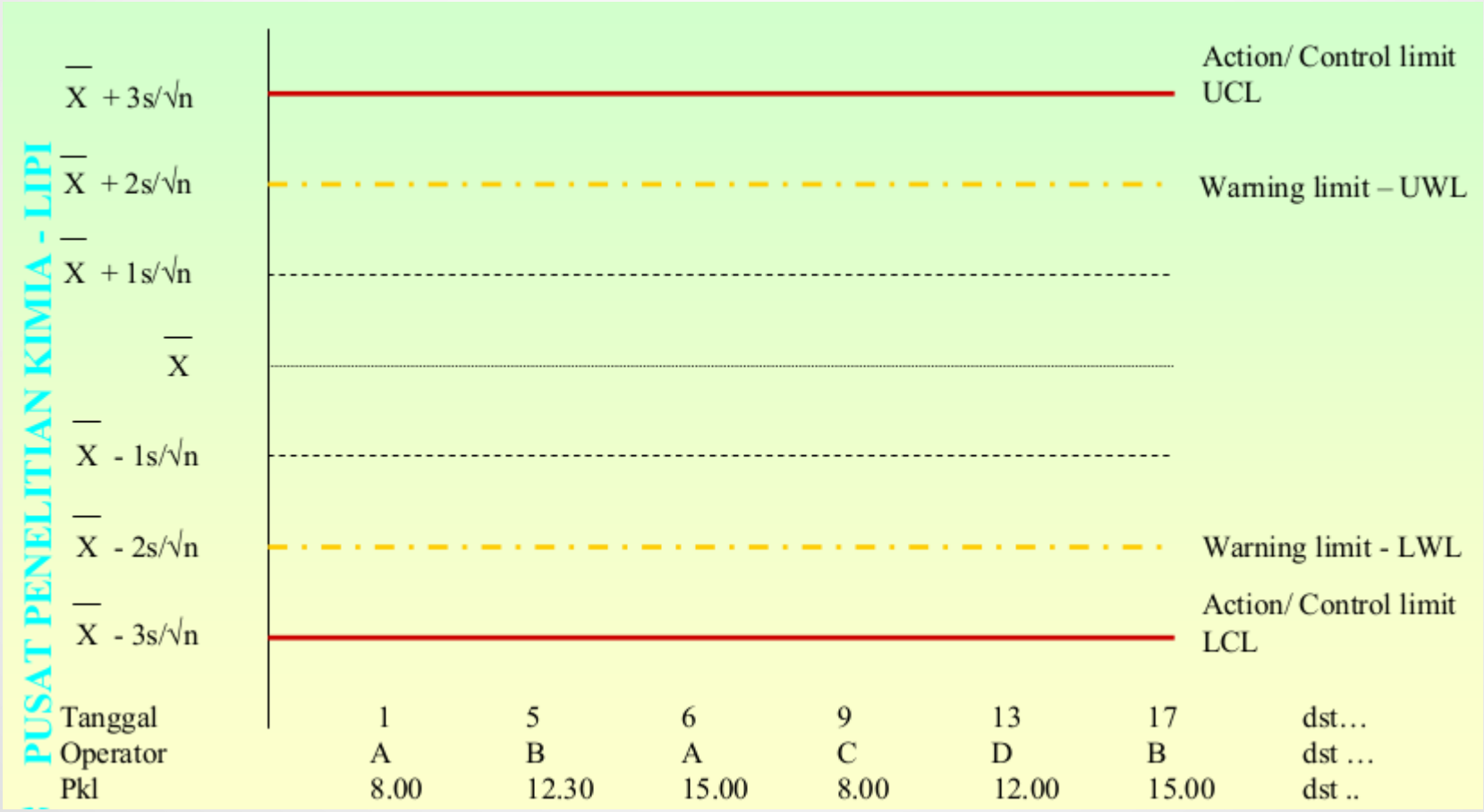
memantau presisi (*repeatability & reproducibility*) dalam satu kurun waktu (hari ke bulan)

menunjukkan bahwa proses analisis berada dibawah kontrol statistika

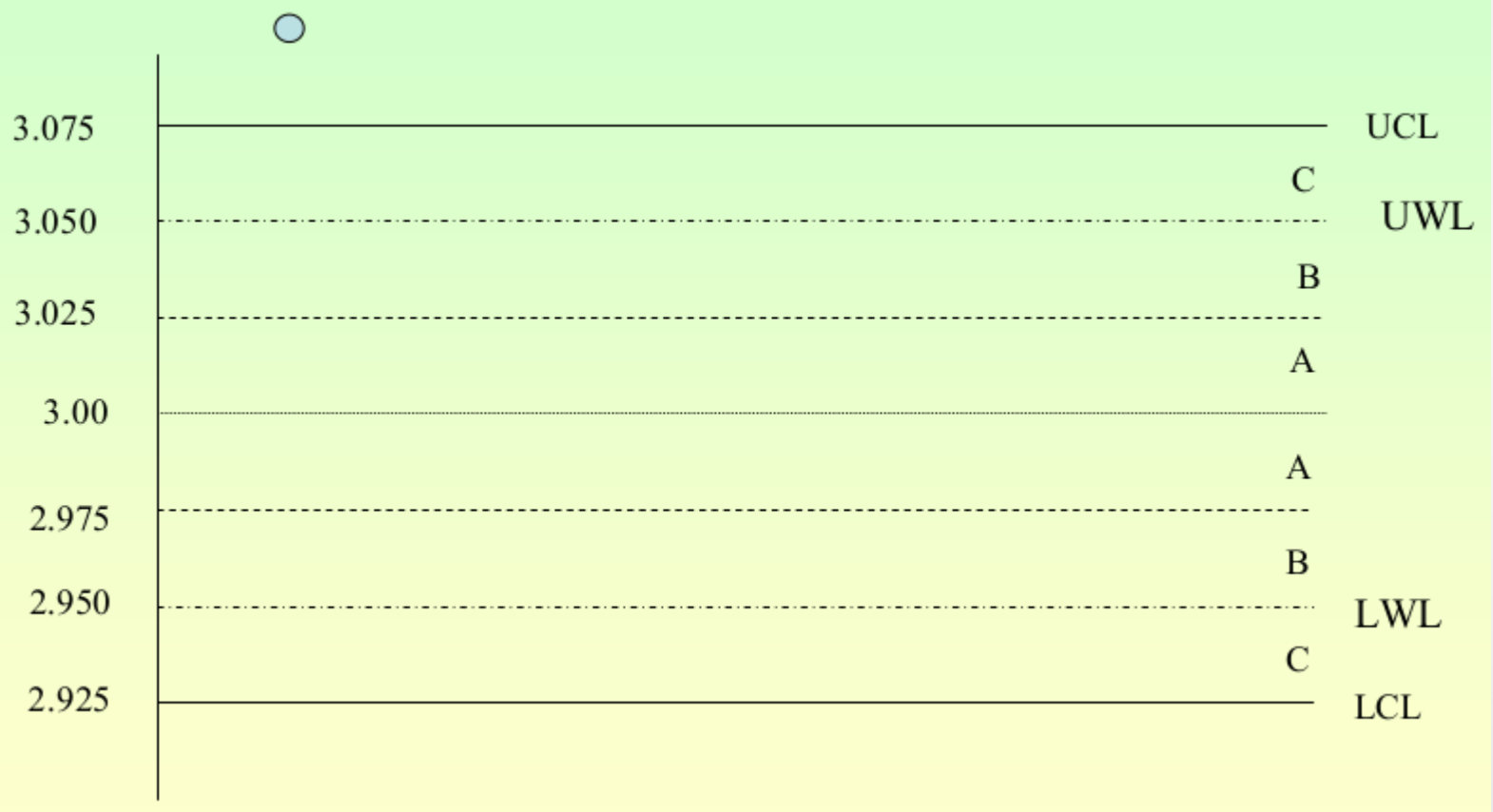
Kontrol sampel

- Homogen
- Stabil
- Matriks sama
- Mudah diperoleh
- Murah

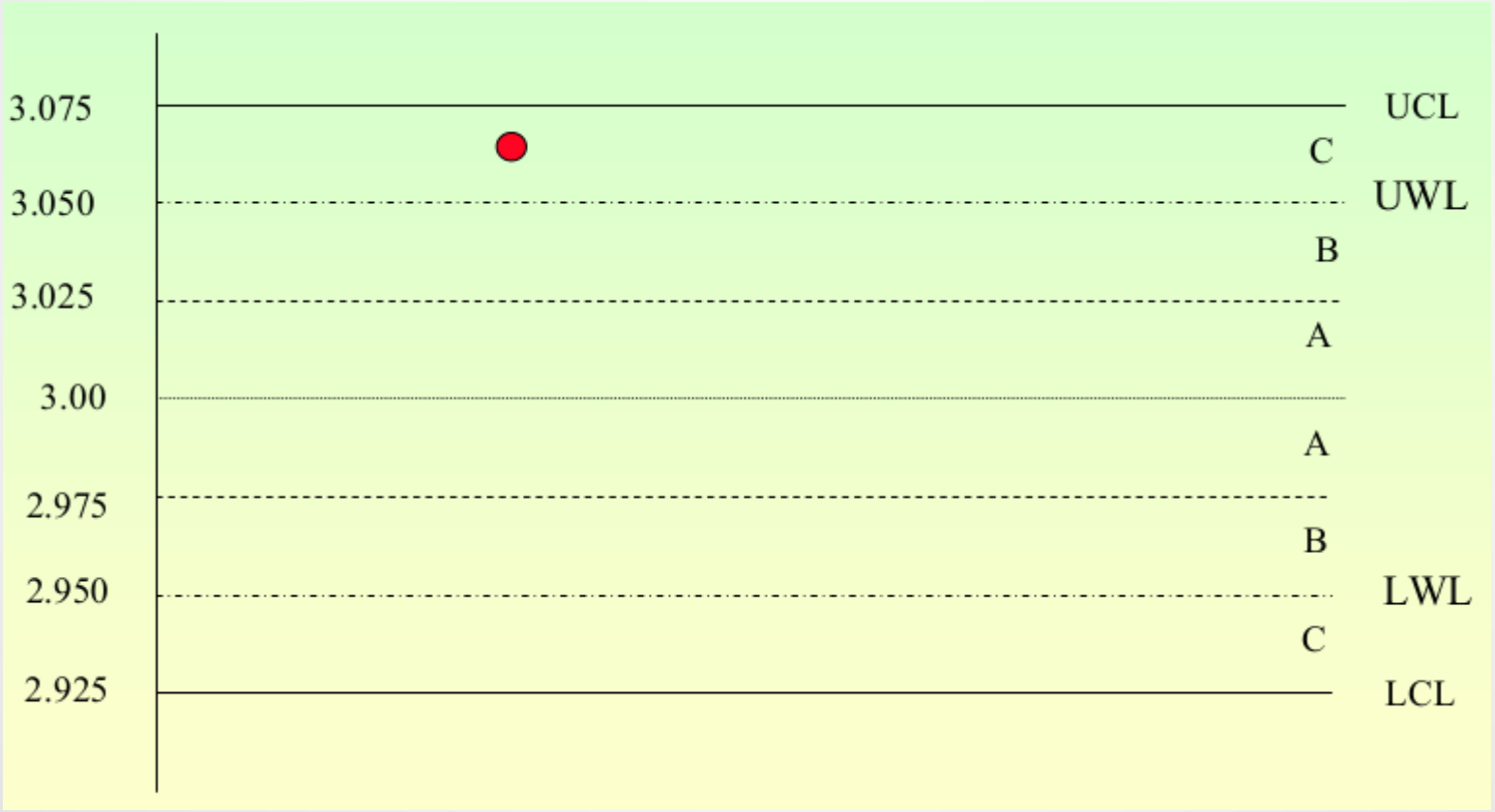
Control Chart



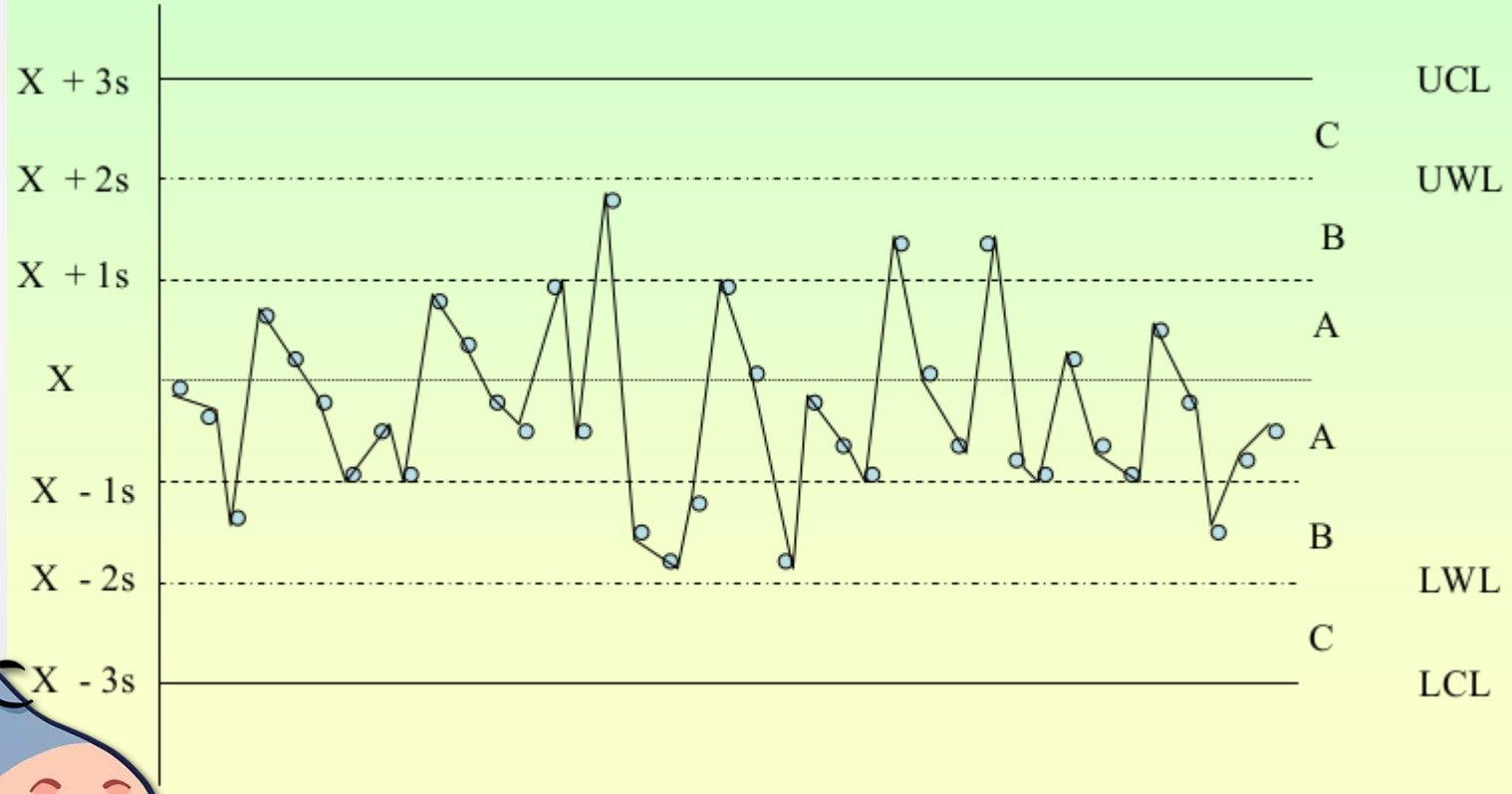
Control Chart (contoh kasus)

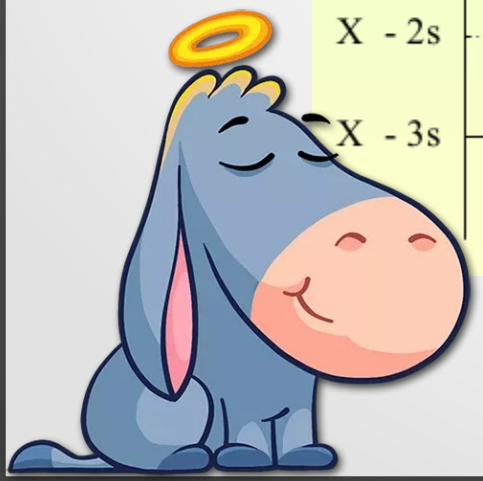


Control Chart (contoh kasus)



Control Chart (contoh kasus)





TERIMA KASIH

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