LAMPIRAN

Lampiran 1 Perhitungan Uji Keseragaman Data

1. *Workstation* 1B

Pekerja 1

j) Jumlah pengamatan (n) = 15

k) $\sum xi = 307{,}11$

l) $\bar{x} = \frac{\sum xi}{15} = \frac{307{,}11}{15} = 20{,}474$

m) $(\sum xi^2) = 94316{,}55$

n) $\sum xi^2 = 6305{,}63$

o) $\sum(xi - \bar{x})^2 = 17{,}86$

p) Standar deviasi

$$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N - 1}} = \sqrt{\frac{17{,}86}{14}} = 1{,}129$$

q) Tingkat ketelitian (s)

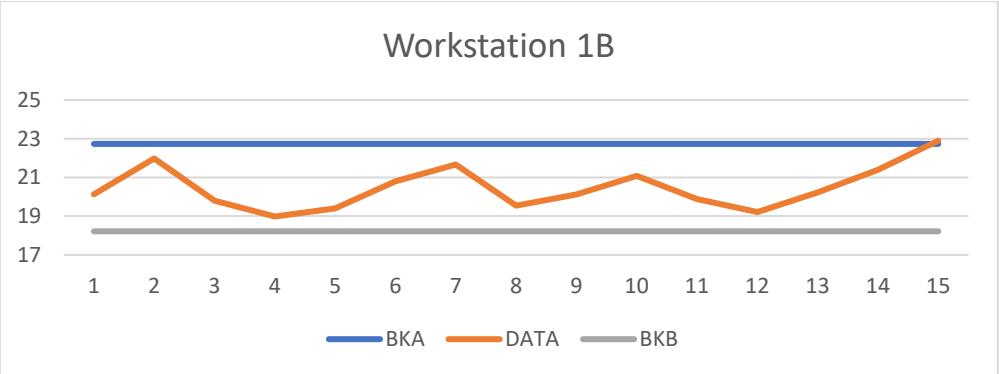
$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1{,}129}{20{,}474} = 0{,}0552$

r) Tingkat kepercayaan (k)

$CL = 100\% - s = 100\% - 0{,}0552 = 94{,}48\% \approx 2$

Uji Keseragaman Data

- $BKA = \bar{x} + k \times \sigma = 20{,}474 + 2 \times 1{,}129 = 22{,}73$
- $BKB = \bar{x} - k \times \sigma = 20{,}474 - 2 \times 1{,}129 = 18{,}21$



Dapat dilihat bahwa semua data pengamatan pada *Workstation 1B* tidak ada yang melebihi Batas Kontrol Atas (BKA) dan Batas Kontrol Bawah (BKB), maka data pengamatan pada *Workstation 1B* dapat dikatakan sudah seragam.

2. *Workstation* 2

Pekerja 1

a) Jumlah pengamatan (n) = 15

b) $\sum xi = 823{,}53$

c) $\bar{x} = \frac{\sum xi}{15} = \frac{823{,}53}{15} = 54{,}902$

d) $(\sum xi^2) = 678201{,}7$

e) $\sum xi^2 = 45249{,}90$

f) $\sum(xi - \bar{x})^2 = 36{,}45$

g) Standar deviasi

$$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N - 1}} = \sqrt{\frac{36{,}45}{14}} = 1{,}614$$

h) Tingkat ketelitian (s)

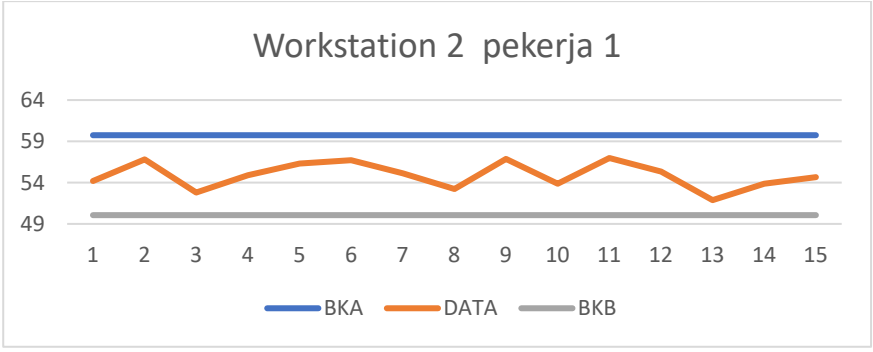
$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1{,}614}{54{,}902} = 0{,}02942$

i) Tingkat kepercayaan (k)

$CL = 100\% - s = 100\% - 0{,}0294 = 97{,}06\% \approx 3$

Uji Keseragaman Data

- $BKA = \bar{x} + k \times \sigma = 54{,}902 + 3 \times 1{,}614 = 59{,}74$
- $BKB = \bar{x} - k \times \sigma = 54{,}902 - 3 \times 1{,}614 = 50{,}06$



Dapat dilihat bahwa semua data pengamatan pada *Workstation 2* pekerja ke 1 masuk dalam BKA dan BKB, maka data pengamatan tersebut sudah seragam.

Pekerja 2

a) Jumlah pengamatan (n) = 15

b) $\sum xi = 843{,}71$

c) $\bar{x} = \frac{\sum xi}{15} = \frac{843{,}71}{15} = 56{,}247$

d) $(\sum xi^2) = 711846{,}6$

e) $\sum xi^2 = 47491{,}69$

f) $\sum(xi - \bar{x})^2 = 35{,}25$

g) Standar deviasi

$$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N - 1}} = \sqrt{\frac{35{,}25}{14}} = 1{,}587$$

h) Tingkat ketelitian (s)

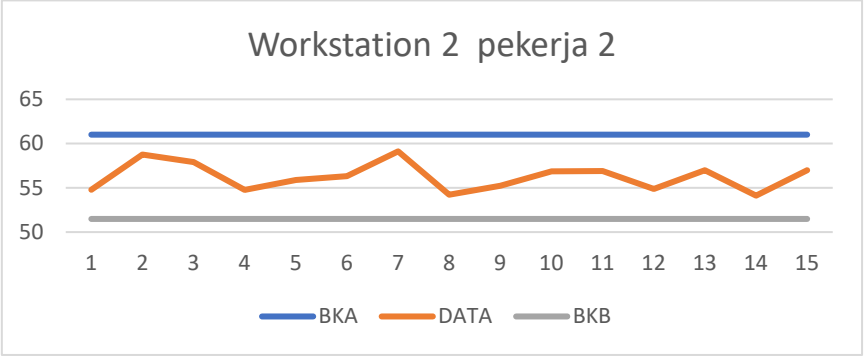
$$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1{,}587}{56{,}247} = 0{,}0282$$

i) Tingkat kepercayaan (k)

$CL = 100\% - s = 100\% - 0{,}0282 = 97{,}18\% \approx 3$

Uji Keseragaman Data

- $BKA = \bar{x} + k \times \sigma = 56{,}247 + 3 \times 1{,}587 = 61{,}01$
- $BKB = \bar{x} - k \times \sigma = 56{,}247 - 3 \times 1{,}587 = 51{,}49$



Dapat dilihat bahwa semua data pengamatan pada *Workstation 2* pekerja ke 2 masuk dalam BKA dan BKB, maka data pengamatan tersebut sudah seragam.

3. *Workstation* 3

Pekerja 1

a) Jumlah pengamatan (n) = 15

b) $\sum xi = 287{,}24$

c) $\bar{x} = \frac{\sum xi}{15} = \frac{287,24}{15} = 19,149$
d) $(\sum xi^2) = 82506,82$
e) $\sum xi^2 = 5519,97$
f) $\sum(xi - \bar{x})^2 = 19,51$
g) Standar deviasi

$$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N - 1}} = \sqrt{\frac{19,51}{14}} = 1,181$$

h) Tingkat ketelitian (s)

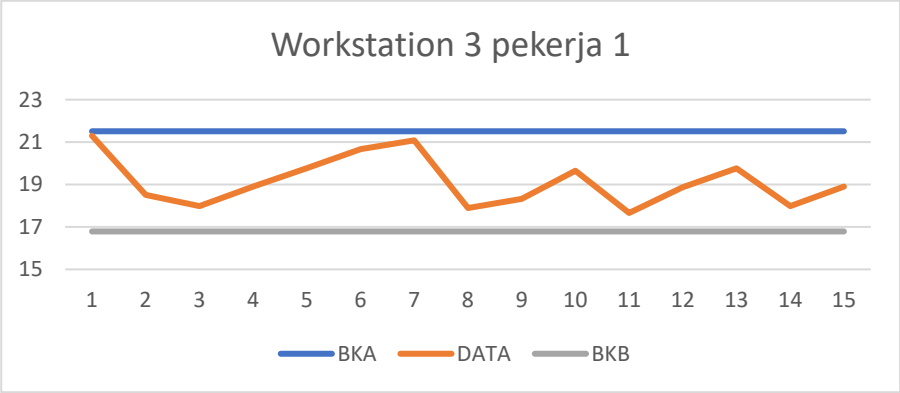
$$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1,181}{19,149} = 0,0616$$

i) Tingkat kepercayaan (k)

$$CL = 100\% - s = 100\% - 0,0616 = 93,84\% \approx 2$$

Uji Keseragaman Data

- $BKA = \bar{x} + k \times \sigma = 19,149 + 2 \times 1,181 = 21,51$
- $BKB = \bar{x} - k \times \sigma = 19,149 - 2 \times 1,181 = 16,79$



Dapat dilihat bahwa semua data pengamatan pada Workstation 3 pekerja ke 1 masuk dalam BKA dan BKB, maka data pengamatan tersebut sudah seragam.

Pekerja 2

a) Jumlah pengamatan (n) = 15
b) $\sum xi = 294,65$
c) $\bar{x} = \frac{\sum xi}{15} = \frac{294,65}{15} = 19,643$
d) $(\sum xi^2) = 86818,62$
e) $\sum xi^2 = 5813,12$

f) $\sum(xi - \bar{x})^2 = 25{,}21$

g) Standar deviasi

$$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N - 1}} = \sqrt{\frac{25{,}21}{14}} = 1{,}342$$

h) Tingkat ketelitian (s)

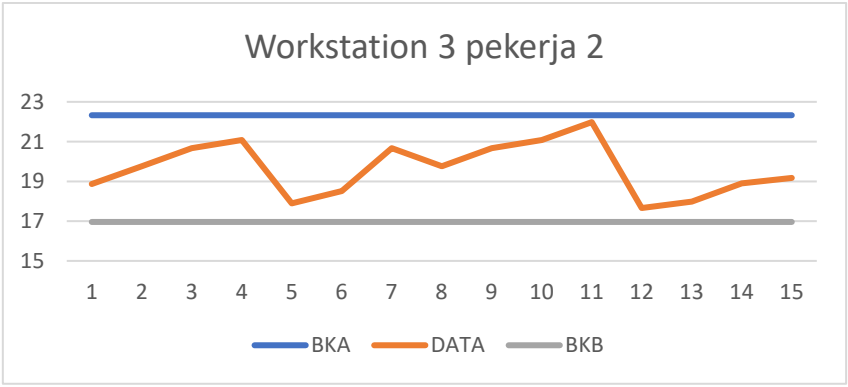
$$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1{,}342}{19{,}643} = 0{,}0683$$

i) Tingkat kepercayaan (k)

$$CL = 100\% - s = 100\% - 0{,}0683 = 93{,}17\% \approx 2$$

Uji Keseragaman Data

- $BKA = \bar{x} + k \times \sigma = 19{,}643 + 2 \times 1{,}342 = 22{,}33$
- $BKB = \bar{x} - k \times \sigma = 19{,}643 - 2 \times 1{,}342 = 16{,}96$



Dapat dilihat bahwa semua data pengamatan pada Workstation 3 pekerja ke 2 masuk dalam BKA dan BKB, maka data pengamatan tersebut sudah seragam.

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Lampiran 2 Uji Kecukupan Data

1. *Workstation* 1B

   Pekerja 1

   a) Jumlah pengamatan (n) = 15
   b) $\sum xi = 307{,}11$
   c) $\bar{x} = \frac{\sum xi}{15} = \frac{307{,}11}{15} = 20{,}474$
   d) $(\sum xi^2) = 94316{,}55$
   e) $\sum xi^2 = 6305{,}63$
   f) $\sum(xi - \bar{x})^2 = 17{,}86$
   g) Standar deviasi

      $$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N - 1}} = \sqrt{\frac{17{,}86}{14}} = 1{,}129$$

   h) Tingkat ketelitian (s)

      $s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1{,}129}{20{,}474} = 0{,}0552$

   i) Tingkat kepercayaan (k)

      $CL = 100\% - s = 100\% - 0{,}0552 = 94{,}48\% \approx 2$

   Uji Kecukupan Data

   - $N' = \left(\frac{\frac{k}{s}\sqrt{N \times \sum xi^2 - (\sum xi^2)}}{\sum xi}\right)^2$
   - $N' = \left(\frac{\frac{2}{0{,}0552}\sqrt{15 \times 6305{,}63 - 94316{,}55}}{307{,}11}\right)^2$
   - $N' = 3{,}7 \approx 4$

2. *Workstation* 2

   Pekerja 1

   a) Jumlah pengamatan (n) = 15
   b) $\sum xi = 823{,}53$
   c) $\bar{x} = \frac{\sum xi}{15} = \frac{823{,}53}{15} = 54{,}902$
   d) $(\sum xi^2) = 678201{,}7$
   e) $\sum xi^2 = 45249{,}90$
   f) $\sum(xi - \bar{x})^2 = 36{,}45$
   g) Standar deviasi

$$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N-1}} = \sqrt{\frac{36{,}45}{14}} = 1{,}614$$

h) Tingkat ketelitian (s)

$$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1{,}614}{54{,}902} = 0{,}02942$$

i) Tingkat kepercayaan (k)

$$CL = 100\% - s = 100\% - 0{,}0294 = 97{,}06\% \approx 3$$

Uji Kecukupan Data

- $N' = \left(\frac{\frac{k}{s}\sqrt{N \times \sum xi^2 - (\sum xi^2)}}{\sum xi}\right)^2$
- $N' = \left(\frac{\frac{3}{0{,}02942}\sqrt{15 \times 45249{,}90 - 678201{,}7}}{823{,}53}\right)^2$
- $N' = 8{,}4 \approx 8$

Pekerja 2

a) Jumlah pengamatan (n) = 15

b) $\sum xi = 843{,}71$

c) $\bar{x} = \frac{\sum xi}{15} = \frac{843{,}71}{15} = 56{,}247$

d) $(\sum xi^2) = 711846{,}6$

e) $\sum xi^2 = 47491{,}69$

f) $\sum(xi - \bar{x})^2 = 35{,}25$

g) Standar deviasi

$$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N-1}} = \sqrt{\frac{35{,}25}{14}} = 1{,}587$$

h) Tingkat ketelitian (s)

$$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1{,}587}{56{,}247} = 0{,}0282$$

i) Tingkat kepercayaan (k)

$$CL = 100\% - s = 100\% - 0{,}0282 = 97{,}18\% \approx 3$$

Uji Kecukupan Data

- $N' = \left(\frac{\frac{k}{s}\sqrt{N \times \sum xi^2 - (\sum xi^2)}}{\sum xi}\right)^2$

- $N' = \left(\frac{\frac{3}{0,0282}\sqrt{15 \times 47491,69 - 711846,6}}{823,53} \right)^2$
- $N' = 8,4 \approx 8$

3. *Workstation* 3

Pekerja 1

a) Jumlah pengamatan (n) = 15
b) $\sum xi = 287,24$
c) $\bar{x} = \frac{\sum xi}{15} = \frac{287,24}{15} = 19,149$
d) $(\sum xi^2) = 82506,82$
e) $\sum xi^2 = 5519,97$
f) $\sum (xi - \bar{x})^2 = 19,51$
g) Standar deviasi

$$\sigma = \sqrt{\frac{\sum (xi - \bar{x})^2}{N - 1}} = \sqrt{\frac{19,51}{14}} = 1,181$$

h) Tingkat ketelitian (s)

$$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1,181}{19,149} = 0,0616$$

i) Tingkat kepercayaan (k)

$$CL = 100\% - s = 100\% - 0,0616 = 93,84\% \approx 2$$

Uji Kecukupan Data

- $N' = \left(\frac{\frac{k}{s}\sqrt{N \times \sum xi^2 - (\sum xi^2)}}{\sum xi} \right)^2$
- $N' = \left(\frac{\frac{2}{0,0616}\sqrt{15 \times 5519,97 - 82506,82}}{287,24} \right)^2$
- $N' = 3,7 \approx 4$

Pekerja 2

a) Jumlah pengamatan (n) = 15
b) $\sum xi = 294,65$
c) $\bar{x} = \frac{\sum xi}{15} = \frac{294,65}{15} = 19,643$
d) $(\sum xi^2) = 86818,62$
e) $\sum xi^2 = 5813,12$
f) $\sum (xi - \bar{x})^2 = 25,21$
g) Standar deviasi

$$\sigma = \sqrt{\frac{\sum(xi - \bar{x})^2}{N-1}} = \sqrt{\frac{25{,}21}{14}} = 1{,}342$$

h) Tingkat ketelitian (s)

$$s = \frac{\sigma}{\bar{x}} \times 100\% = \frac{1{,}342}{19{,}643} = 0{,}0683$$

i) Tingkat kepercayaan (k)

$$CL = 100\% - s = 100\% - 0{,}0683 = 93{,}17\% \approx 2$$

Uji Kecukupan Data

- $N' = \left(\frac{\frac{k}{s}\sqrt{N \times \sum xi^2 - (\sum xi^2)}}{\sum xi}\right)^2$
- $N' = \left(\frac{\frac{2}{0{,}0683}\sqrt{15 \times 5813{,}12 - 86818{,}62}}{294{,}65}\right)^2$
- $N' = 3{,}7 \approx 4$

Lampiran 3 Perhitungan Waktu Normal

1. *Workstation 1B*
   $Wn = \bar{x} \times Performance\ rating(\%)$
   $Wn = 20{,}474 \times 1{,}16 = 23{,}75$
2. *Workstation 2*
   - Pekerja 1
     $Wn = \bar{x} \times Performance\ rating(\%)$
     $Wn = 54{,}902 \times 0{,}98 = 53{,}804$
   - Pekerja 2
     $Wn = \bar{x} \times Performance\ rating(\%)$
     $Wn = 56{,}25 \times 1{,}06 = 59{,}622$
3. *Workstation 3*
   - Pekerja 1
     $Wn = \bar{x} \times Performance\ rating(\%)$
     $Wn = 19{,}15 \times 1{,}14 = 21{,}83$
   - Pekerja 2
     $Wn = \bar{x} \times Performance\ rating(\%)$
     $Wn = 19{,}64 \times 1{,}14 = 22{,}39$

Lampiran 4 Perhitungan Waktu Standart (Ws)

1. Workstation 1B

$$Ws = Wn \times \frac{100\%}{100\% - allowance}$$

$$Ws = 23{,}75 \times \frac{100\%}{100\% - 20{,}5\%} = 29{,}87$$

2. Workstation 2
   a) Pekerja 1

$$Ws = Wn \times \frac{100\%}{100\% - allowance}$$

$$Ws = 53{,}80 \times \frac{100\%}{100\% - 23{,}5\%} = 70{,}33$$

   b) Pekerja 2

$$Ws = Wn \times \frac{100\%}{100\% - allowance}$$

$$Ws = 59{,}62 \times \frac{100\%}{100\% - 20{,}5\%} = 74{,}99$$

3. Workstation 3
   a) Pekerja 1

$$Ws = Wn \times \frac{100\%}{100\% - allowance}$$

$$Ws = 21{,}83 \times \frac{100\%}{100\% - 20{,}5\%} = 27{,}46$$

   b) Pekerja 2

$$Ws = Wn \times \frac{100\%}{100\% - allowance}$$

$$Ws = 22{,}39 \times \frac{100\%}{100\% - 20{,}5\%} = 28{,}17$$