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## UAS KECERDASAN BUATAN

### PERHITUNGAN MANUAL MENENTUKAN KECEPATAN PUTARAN MESIN CUCI DENGAN MENGGUNAKAN METODE FUZZY TSUKAMOTO

Terdapat 3 variabel, yaitu: 2 variabel input, variabel pakaian, dan variabel kekotoran, sedangkan untuk output terdapat 1 variabel, yaitu: putaran.

- ✚ Variabel Pakaian memiliki 3 nilai linguistik, yaitu: sedikit, sedang dan banyak
- ✚ Variabel Kekotoran memiliki 4 nilai linguistik, yaitu: rendah, sedang, tinggi, sangat tinggi  
Sedangkan variabel produksi barang memiliki 2 nilai linguistik, yaitu: lambat dan cepat

Pakaian terendah = 40

Pakaian sedang = 60

Pakaian tertinggi = 80

Kekotoran terendah = 40

Kekotoran sedang = 50

Kekotoran tinggi = 60

Kekotoran tertinggi = 70

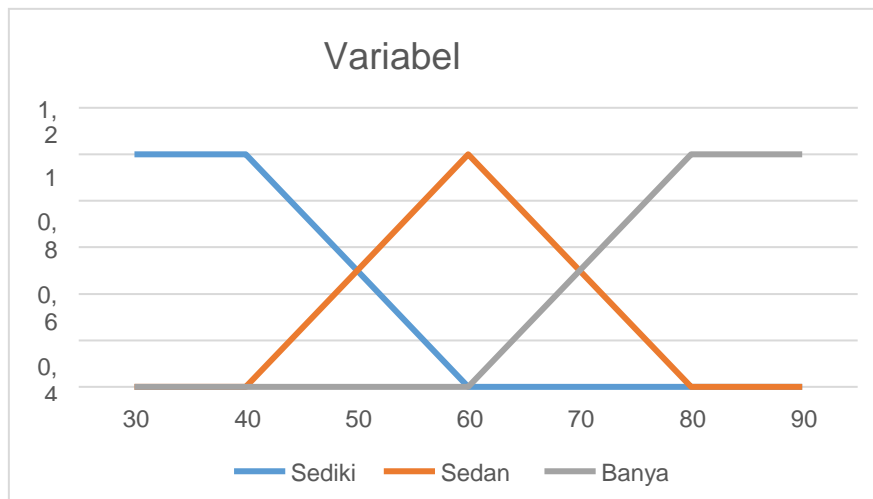
Contoh Soal:

Hitunglah kecepatan putaran mesin cuci dengan metode tsukamoto, Jika banyaknya pakaian adalah 65 dan tingkat kekotoran adalah 56.

Jawab:

#### 1. Fuzifikasi

##### 1. Variabel Pakaian



$$a. \mu_{\text{Rendah}}(x) = \begin{cases} 0 & ; x \geq 60 \\ \frac{60-x}{60-40} & ; 40 \leq x \leq 60 \\ 1 & ; x \leq 40 \end{cases}$$

$$\mu_{\text{Rendah}}(65) = 0$$

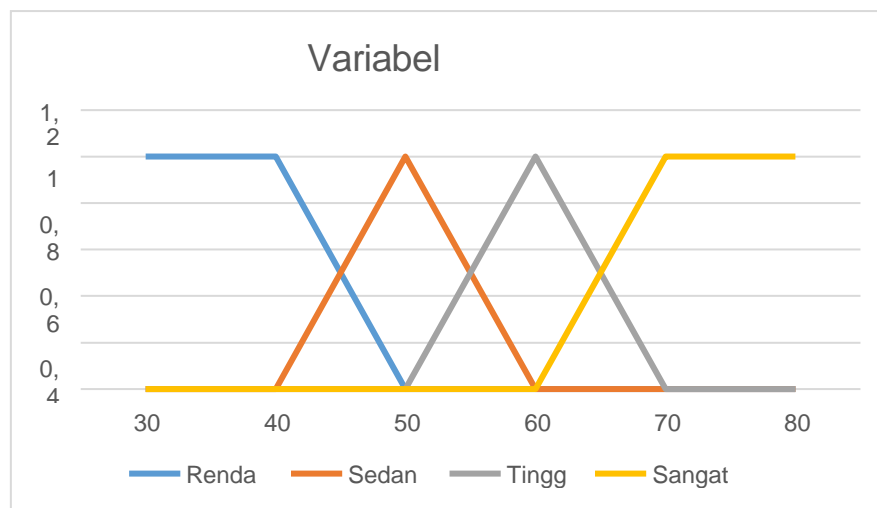
$$b. \mu_{\text{Sedan}}(x) = \begin{cases} 0 & ; x \leq 40 \text{ atau } x \geq 80 \\ \frac{x-40}{60-40} & ; 40 \leq x \leq 60 \\ \frac{80-x}{80-60} & ; 60 \leq x \leq 80 \end{cases}$$

$$\mu_{\text{Sedan}}(65) = \frac{80-65}{80-60} = 0,75$$

$$c. \mu_{\text{Tinggi}}(x) = \begin{cases} 0 & ; x \leq 60 \\ \frac{x-60}{80-60} & ; 60 \leq x \leq 80 \\ 1 & ; x \geq 80 \end{cases}$$

$$\mu_{\text{Tinggi}}(65) = \frac{65-60}{80-60} = 0,25$$

## 2. Variabel Kekotoran



$$a. \mu_{\text{Rendah}}(x) = \begin{cases} 0 & ; x \geq 50 \\ \frac{50-x}{50-40} & ; 40 \leq x \leq 50 \\ 1 & ; x \leq 40 \end{cases}$$

$$\mu_{\text{Rendah}}(56) = 0$$

$$b. \mu_{50-40}(\square) = \begin{cases} 0; \square \leq 40 \\ \frac{\square - 40}{60 - 50}; 40 \leq \square \leq 50 \\ \frac{60 - \square}{60 - 50}; 50 \leq \square \leq 60 \\ 1; \square \geq 60 \end{cases}$$

$$\mu_{50-40}(56) = \frac{60 - 56}{60 - 50} = 0.4$$

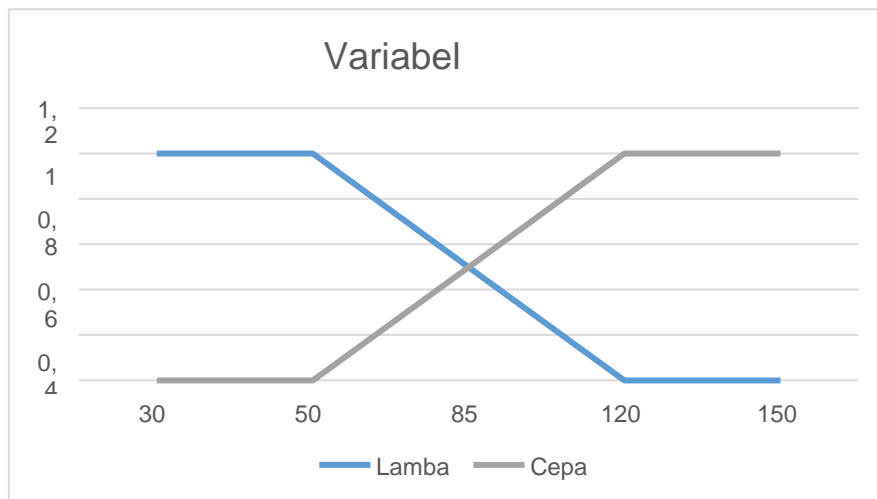
$$c. \mu_{60-50}(\square) = \begin{cases} 0; \square \leq 50 \\ \frac{\square - 50}{60 - 50}; 50 \leq \square \leq 60 \\ \frac{70 - \square}{70 - 60}; 60 \leq \square \leq 70 \\ 1; \square \geq 70 \end{cases}$$

$$\mu_{60-50}(56) = \frac{56 - 50}{60 - 50} = 0.6$$

$$d. \mu_{\square-60}(\square) = \begin{cases} 0; \square \leq 60 \\ \frac{70 - \square}{70 - 60}; 60 \leq \square \leq 70 \\ 1; \square \geq 70 \end{cases}$$

$$\mu_{\square-60}(56) = 0$$

### 3. Variabel Putaran



$$a. \mu_{1200-\square}(\square) = \begin{cases} 0; \square \geq 1200 \\ \frac{1200 - \square}{1200 - 500}; 500 \leq \square \leq 1200 \\ 1; \square \leq 500 \end{cases}$$

$$b. \text{kecepatan putaran}(\omega) = \begin{cases} 0 & ; \omega \leq 500 \\ \frac{\omega - 500}{1200 - 500} & ; 500 \leq \omega \leq 1200 \\ 1 & ; \omega \geq 1200 \end{cases}$$

## 2. Inferensi

Rumus z jika kecepatan putaran lambat =  $z = \text{kecepatan putaran} - \omega * (\text{kecepatan putaran} - \text{kecepatan putaran})$

Rumus z jika kecepatan putaran cepat =  $z = (\text{kecepatan putaran} - \text{kecepatan putaran}) + \text{kecepatan putaran}$

1. If Pakaian sedikit and Kekotoran rendah then Kecepatan putaran lambat

$$\omega_1 = \text{kecepatan putaran}[\omega] \cap \text{kecepatan putaran}h[\omega]$$

$$\omega_1 = \min(\text{kecepatan putaran}[65]; \text{kecepatan putaran}h[56])$$

$$\omega_1 = \min(0; 0)$$

$$\omega_1 = 0$$

$$\omega_1 = \text{kecepatan putaran} - \omega_1 * (\text{kecepatan putaran} - \text{kecepatan putaran})$$

$$\omega_1 = 1200 - 0$$

$$\omega_1 = 1200$$

2. If Pakaian sedikit and Kekotoran setengah then Kecepatan putaran lambat

$$\omega_2 = \text{kecepatan putaran}[\omega] \cap \text{kecepatan putaran}h[\omega]$$

$$\omega_2 = \min(\text{kecepatan putaran}[65]; \text{kecepatan putaran}h[56])$$

$$\omega_2 = \min(0; 0,4)$$

$$\omega_2 = 0$$

$$\omega_2 = \text{kecepatan putaran} - \omega_2 * (\text{kecepatan putaran} - \text{kecepatan putaran})$$

$$\omega_2 = 1200 - 0$$

$$\omega_2 = 1200$$

3. If Pakaian sedikit and Kekotoran tinggi then Kecepatan putaran lambat

$$\omega_3 = \text{kecepatan putaran}[\omega] \cap \text{kecepatan putaran}h[\omega]$$

$$\omega_3 = \min(\text{kecepatan putaran}[65]; \text{kecepatan putaran}h[56])$$

$$\omega_3 = \min(0; 0,6)$$

$$\omega_3 = 0$$

$$\omega_3 = \text{kecepatan putaran} - \omega_3 * (\text{kecepatan putaran} - \text{kecepatan putaran})$$

$$\omega_3 = 1200 - 0$$

$$\omega_3 = 1200$$

4. If Pakaian sedikit and Kekotoran sangat tinggi then Kecepatan putaran cepat

$$\omega_4 = \text{kecepatan putaran}[\omega] \cap \text{kecepatan putaran}_{\text{sangat tinggi}}h[\omega]$$

$$\omega_4 = \min(\text{kecepatan putaran}[65]; \text{kecepatan putaran}_{\text{sangat tinggi}}h[56])$$

$$\omega_4 = \min(0; 0)$$

$$\omega_4 = 0$$

$$\square 4 = \square 4(\square \square \square \square - \square \square \square \square) + \square \square \square \square$$

$$\square 4 = 0(1200 - 500) + 500$$

$$\square 4 = 500$$

5. If Pakaian sedang and Kekotoran rendah then Kecepatan putaran lambat

$$\square 5 = \square \square \square \square \square \square [\square] \cap \square \square \square \square \square \square h [\square]$$

$$\square 5 = \square \square (\square \square \square \square \square \square [65] ; \square \square \square \square \square \square h [56])$$

$$\square 5 = \square \square (0.75; 0)$$

$$\square 5 = 0$$

$$\square 5 = \square \square \square \square - \square 5 * (\square \square \square \square - \square \square \square \square)$$

$$\square 5 = 1200 - 0$$

$$\square 5 = 1200$$

6. If Pakaian sedang and Kekotoran setengah then Kecepatan putaran lambat

$$\square 6 = \square \square \square \square \square \square [\square] \cap \square \square \square \square \square \square [\square]$$

$$\square 6 = \square \square (\square \square \square \square \square \square [65] ; \square \square \square \square \square \square [56])$$

$$\square 6 = \square \square (0.75; 0.4)$$

$$\square 6 = 0.4$$

$$\square 6 = \square \square \square \square - \square 6 * (\square \square \square \square - \square \square \square \square)$$

$$\square 6 = 1200 - 0.4(1200 - 500)$$

$$\square 6 = 920$$

7. If Pakaian sedang and Kekotoran tinggi then Kecepatan putaran cepat

$$\square 7 = \square \square \square \square \square \square [\square] \cap \square \square \square \square \square \square [\square]$$

$$\square 7 = \square \square (\square \square \square \square \square \square [65] ; \square \square \square \square \square \square [56])$$

$$\square 7 = \square \square (0.75; 0.6)$$

$$\square 7 = 0.6$$

$$\square 7 = \square 7(\square \square \square \square - \square \square \square \square) + \square \square \square \square$$

$$\square 7 = 0.6(1200 - 500) + 500$$

$$\square 7 = 920$$

8. If Pakaian sedang and Kekotoran sangat tinggi then Kecepatan putaran cepat

$$\square 8 = \square \square \square \square \square \square [\square] \cap \square \square \square \square \square \square \_ \square \square \square \square \square \square [\square]$$

$$\square 8 = \square \square (\square \square \square \square \square \square [65] ; \square \square \square \square \square \square \_ \square \square \square \square \square \square [56])$$

$$\square 8 = \square \square (0.75; 0)$$

$$\square 8 = 0$$

$$\square 8 = \square 8(\square \square \square \square - \square \square \square \square) + \square \square \square \square$$

$$\square 8 = 0(1200 - 500) + 500$$

$$\square 8 = 500$$

9. If Pakaian banyak and Kekotoran rendah then Kecepatan putaran lambat

$$\square 9 = \square\square\square\square\square\square[\square] \cap \square\square\square\square\square\square h[\square]$$

$$\square 9 = \square\square\square (\square\square\square\square\square\square[65] ; \square\square\square\square\square\square h[56])$$

$$\square 9 = \square\square\square(0.25; 0)$$

$$\square 9 = 0$$

$$\square 9 = \square\square\square\square - \square 9 * (\square\square\square\square - \square\square\square\square)$$

$$\square 9 = 1200 - 0(1200 - 500)$$

$$\square 9 = 1200$$

10. If Pakaian banyak and Kekotoran setengah then Kecepatan putaran cepat

$$\square 10 = \square\square\square\square\square\square[\square] \cap \square\square\square\square\square\square\square h[\square]$$

$$\square 10 = \square\square\square (\square\square\square\square\square\square[65] ; \square\square\square\square\square\square\square h[56])$$

$$\square 10 = \square\square\square(0.25; 0.4)$$

$$\square 10 = 0,25$$

$$\square 10 = \square 10(\square\square\square\square - \square\square\square\square) + \square\square\square\square$$

$$\square 10 = 0.25(1200 - 500) + 500$$

$$\square 10 = 675$$

11. If Pakaian banyak and Kekotoran tinggi then Kecepatan putaran cepat

$$\square 11 = \square\square\square\square\square\square[\square] \cap \square\square\square\square\square\square\square[\square]$$

$$\square 11 = \square\square\square (\square\square\square\square\square\square[65] ; \square\square\square\square\square\square[56])$$

$$\square 11 = \square\square\square(0.25; 0.6)$$

$$\square 11 = 0,25$$

$$\square 11 = \square 11(\square\square\square\square - \square\square\square\square) + \square\square\square\square$$

$$\square 11 = 0.25(1200 - 500) + 500$$

$$\square 11 = 675$$

12. If Pakaian banyak and Kekotoran sangat tinggi then Kecepatan putaran cepat

$$\square 12 = \square\square\square\square\square\square[\square] \cap \square\square\square\square\square\square\square\_ \square\square\square\square\square\square[\square]$$

$$\square 12 = \square\square\square (\square\square\square\square\square\square[65] ; \square\square\square\square\square\square\square\_ \square\square\square\square\square\square[56])$$

$$\square 12 = \square\square\square(0.25; 0.0)$$

$$\square 12 = 0$$

$$\square 12 = \square 12(\square\square\square\square - \square\square\square\square) + \square\square\square\square$$

$$\square 12 = 0(1200 - 500) + 500$$

$$\square 12 = 500$$

### 3. Defuzzifikasi

[illegible]

$$\begin{aligned} & (\square * \square\square\square\square) + (\square * \square\square\square\square) + (\square * \square\square\square\square) + (\square * \square\square\square) + (\square \\ & \quad * \square\square\square\square) \\ \square = & \quad + (\square.\square * \square\square\square.\square) + (\square.\square * \square\square\square.\square) + (\square * \square\square\square) + (\square * \\ & \quad \square\square\square\square) \\ & \quad + (\square.\square\square * \square\square\square.\square) + (\square.\square\square * \square\square\square.\square) + (\square * \square\square\square) \\ \hline & \square + \square + \square + \square + \square + \square.\square + \square.\square + \square + \square + \square + \square.\square\square + \square.\square\square + \square \\ & \quad \square\square\square\square.\square \\ & \square = \frac{\phantom{0000}}{\square.\square} = \square\square\square.\square\square\square \end{aligned}$$

## Kesimpulan

Jika banyaknya pakaian adalah **65** dan tingkat kekotoran adalah **56** maka kecepatan putaran mesin cuci adalah   .