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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 = 30

Pakaian sedang = 70

Pakaian tertinggi = 90

Kekotoran terendah = 50

Kekotoran sedang = 60

Kekotoran tinggi = 70

Kekotoran tertinggi = 80

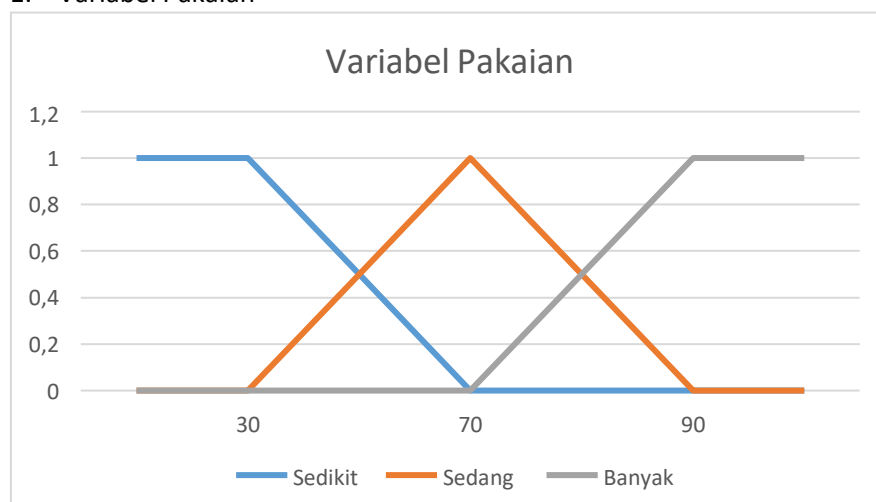
Contoh Soal:

Hitunglah kecepatan putaran mesin cuci dengan metode tsukamoto, Jika banyaknya pakaian adalah 75 dan tingkat kekotoran adalah 66.

Jawab:

1. Fuzifikasi

1. Variabel Pakaian



$$a. \text{sedikit}(x) = \begin{cases} 0 & ; x \geq 70 \\ \frac{60-x}{60-30} & ; 30 \leq x \leq 60 \\ 1 & ; x \leq 30 \end{cases}$$

$$\text{sedikit}(75) = 0$$

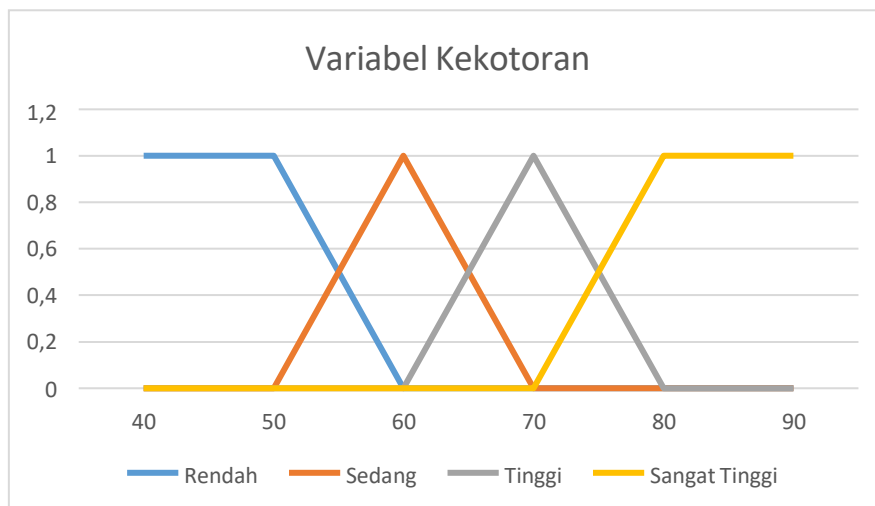
$$b. \text{sedang } x = \begin{cases} 0 & ; x \leq 30 \text{ or } x \geq 90 \\ \frac{x-30}{70-30} & ; 30 \leq x \leq 70 \\ \frac{90-x}{90-70} & ; 70 \leq x \leq 90 \end{cases}$$

$$\text{sedang}(75) = \frac{90-75}{90-70} = 0,75$$

$$c. \text{banyak}(x) = \begin{cases} 0 & ; x \leq 70 \\ \frac{x-70}{90-70} & ; 70 \leq x \leq 90 \\ 1 & ; x \geq 90 \end{cases}$$

$$\text{banyak}(75) = \frac{75-70}{90-70} = 0,25$$

2. Variabel Kekotoran



$$a. \text{rendah}(x) = \begin{cases} 0 & ; x \geq 60 \\ \frac{60-x}{60-50} & ; 50 \leq x \leq 60 \\ 1 & ; x \leq 50 \end{cases}$$

rendah(66) = 0

$$\text{b. } \text{sedang}(x) = \begin{cases} 0 & ; x \leq 50 \text{ or } x \geq 70 \\ \frac{x-50}{60-50} & ; 50 \leq x \leq 60 \\ \frac{70-x}{70-60} & ; 60 \leq x \leq 70 \end{cases}$$

$$\text{sedang}(66) = \frac{70-66}{70-60} = 0.4$$

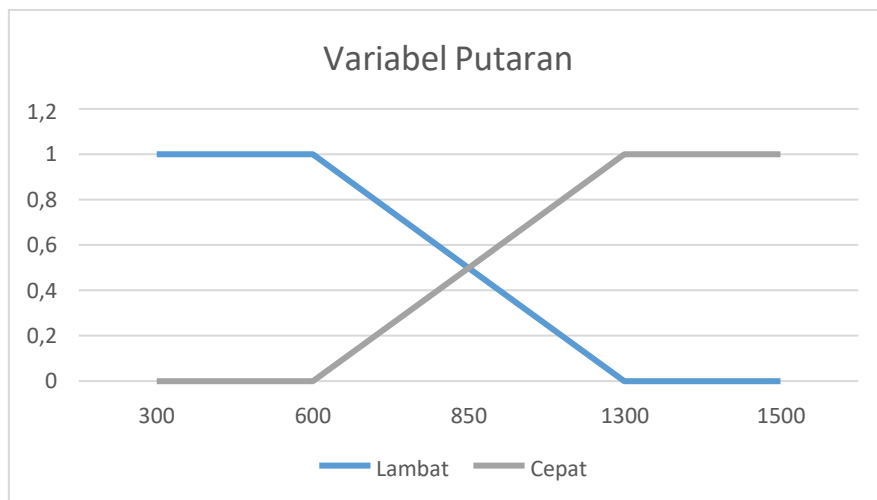
$$\text{c. } \text{tinggi}(x) = \begin{cases} 0 & ; x \leq 60 \text{ or } x \geq 80 \\ \frac{x-60}{70-60} & ; 60 \leq x \leq 70 \\ \frac{80-x}{80-70} & ; 70 \leq x \leq 80 \end{cases}$$

$$\text{tinggi}(66) = \frac{66-60}{70-60} = 0.6$$

$$\text{d. } \text{sangat_tinggi}(x) = \begin{cases} 0 & ; x \leq 70 \\ \frac{x-70}{80-70} & ; 70 \leq x \leq 80 \\ 1 & ; x \geq 80 \end{cases}$$

$$\text{sangat_tinggi}(66) = 0$$

3. Variabel Putaran



$$\text{a. } \text{lambat}(z) = \begin{cases} 0 & ; z \geq 1300 \\ \frac{1300-z}{1300-600} & ; 600 \leq z \leq 1300 \\ 1 & ; z \leq 600 \end{cases}$$

$$b. \text{cepat}(x) = \begin{cases} 0 & ; z \leq 600 \\ \frac{z-600}{1300-600} & ; 600 \leq z \leq 1300 \\ 1 & ; x \leq 600 \end{cases}$$

2. Inferensi

Rumus z jika kecepatan putaran lambat = $z = z_{max} - a * (z_{max} - z_{min})$

Rumus z jika kecepatan putaran cepat $z = a(z_{max} - z_{min}) + z_{min}$

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

$$a1 = \mu_{sedikit}[X] \cap \mu_{rendah}[Y]$$

$$a1 = \min(\mu_{sedikit}[75] ; \mu_{rendah}[66])$$

$$a1 = \min(0; 0)$$

$$a1 = 0$$

$$z1 = z_{max} - a1 * (z_{max} - z_{min})$$

$$z1 = 1300 - 0$$

$$z1 = 1300$$

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

$$a2 = \mu_{sedikit}[X] \cap \mu_{setengah}[Y]$$

$$a2 = \min(\mu_{sedikit}[75] ; \mu_{setengah}[66])$$

$$a2 = \min(0; 0,4)$$

$$a2 = 0$$

$$z2 = z_{max} - a2 * (z_{max} - z_{min})$$

$$z2 = 1300 - 0$$

$$z2 = 1300$$

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

$$a3 = \mu_{sedikit}[X] \cap \mu_{tinggi}[Y]$$

$$a3 = \min(\mu_{sedikit}[75] ; \mu_{tinggi}[66])$$

$$a3 = \min(0; 0,6)$$

$$a3 = 0$$

$$z3 = z_{max} - a3 * (z_{max} - z_{min})$$

$$z3 = 1300 - 0$$

$$z3 = 1300$$

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

$$a4 = \mu_{sedikit}[X] \cap \mu_{sangat_tinggi}[Y]$$

$$a4 = \min(\mu_{sedikit}[75] ; \mu_{sangat_tinggi}[66])$$

$$a4 = \min(0; 0)$$

$$a4 = 0$$

$$z4 = a4(zmax - zmin) + zmin$$

$$z4 = 0(1300 - 600) + 600$$

$$z4 = 600$$

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

$$a5 = \mu_{sedang}[X] \cap \mu_{rendah}[Y]$$

$$a5 = \min(\mu_{sedang}[75]; \mu_{rendah}[66])$$

$$a5 = \min(0.75; 0)$$

$$a5 = 0$$

$$z5 = zmax - a5 * (zmax - zmin)$$

$$z5 = 1300 - 0$$

$$z5 = 1300$$

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

$$a6 = \mu_{sedang}[X] \cap \mu_{sedang}[Y]$$

$$a6 = \min(\mu_{sedang}[75]; \mu_{sedang}[66])$$

$$a6 = \min(0.75; 0.4)$$

$$a6 = 0.4$$

$$z6 = zmax - a6 * (zmax - zmin)$$

$$z6 = 1300 - 0.4(1300 - 600)$$

$$z6 = 1020$$

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

$$a7 = \mu_{sedang}[X] \cap \mu_{tinggi}[Y]$$

$$a7 = \min(\mu_{sedang}[75]; \mu_{tinggi}[66])$$

$$a7 = \min(0.75; 0.6)$$

$$a7 = 0.6$$

$$z7 = a7(zmax - zmin) + zmin$$

$$z7 = 0.6(1300 - 600) + 600$$

$$z7 = 1020$$

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

$$a8 = \mu_{sedang}[X] \cap \mu_{sangat_tinggi}[Y]$$

$$a8 = \min(\mu_{sedang}[75]; \mu_{sangat_tinggi}[66])$$

$$a8 = \min(0.75; 0)$$

$$a8 = 0$$

$$z8 = a8(zmax - zmin) + zmin$$

$$z8 = 0(1300 - 600) + 600$$

$$z8 = 600$$

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

$$a_9 = \mu_{\text{banyak}}[X] \cap \mu_{\text{rendah}}[Y]$$

$$a_9 = \min(\mu_{\text{banyak}}[75]; \mu_{\text{rendah}}[66])$$

$$a_9 = \min(0.25; 0)$$

$$a_9 = 0$$

$$z_9 = z_{\text{max}} - a_9 * (z_{\text{max}} - z_{\text{min}})$$

$$z_9 = 1300 - 0(1300 - 600)$$

$$z_9 = 1300$$

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

$$a_{10} = \mu_{\text{banyak}}[X] \cap \mu_{\text{setengah}}[Y]$$

$$a_{10} = \min(\mu_{\text{banyak}}[75]; \mu_{\text{setengah}}[66])$$

$$a_{10} = \min(0.25; 0.4)$$

$$a_{10} = 0.25$$

$$z_{10} = a_{10}(z_{\text{max}} - z_{\text{min}}) + z_{\text{min}}$$

$$z_{10} = 0.25(1300 - 600) + 600$$

$$z_{10} = 775$$

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

$$a_{11} = \mu_{\text{banyak}}[X] \cap \mu_{\text{tinggi}}[Y]$$

$$a_{11} = \min(\mu_{\text{banyak}}[75]; \mu_{\text{tinggi}}[66])$$

$$a_{11} = \min(0.25; 0.6)$$

$$a_{11} = 0.25$$

$$z_{11} = a_{11}(z_{\text{max}} - z_{\text{min}}) + z_{\text{min}}$$

$$z_{11} = 0.25(1300 - 600) + 600$$

$$z_{11} = 775$$

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

$$a_{12} = \mu_{\text{banyak}}[X] \cap \mu_{\text{sangat_tinggi}}[Y]$$

$$a_{12} = \min(\mu_{\text{banyak}}[75]; \mu_{\text{sangat_tinggi}}[66])$$

$$a_{12} = \min(0.25; 0.0)$$

$$a_{12} = 0$$

$$z_{12} = a_{12}(z_{\text{max}} - z_{\text{min}}) + z_{\text{min}}$$

$$z_{12} = 0(1300 - 600) + 600$$

$$z_{12} = 600$$

3. Defuzzifikasi

$$Z = \frac{a_1 * z_1 + a_2 * z_2 + a_3 * z_3 + a_4 * z_4 + a_5 * z_5 + a_6 * z_6 + a_7 * z_7 + a_8 * z_8 + a_9 * z_9 + a_{10} * z_{10} + a_{11} * z_{11} + a_{12} * z_{12}}{a_1 + a_2 + a_3 + a_4 + a_5 + a_6 + a_7 + a_8 + a_9 + a_{10} + a_{11} + a_{12}}$$

$$Z = \frac{(0 * 1300) + (0 * 1300) + (0 * 1300) + (0 * 600) + (0 * 1300) + (0.4 * 1020.0) + (0.6 * 1020.0) + (0 * 600) + (0 * 1300) + (0.25 * 775.0) + (0.25 * 775.0) + (0 * 600)}{0 + 0 + 0 + 0 + 0 + 0.4 + 0.6 + 0 + 0 + 0.25 + 0.25 + 0} = \frac{1407.5}{1.5} = 938.333$$

Kesimpulan

Jika banyaknya pakaian adalah 75 dan tingkat kekotoran adalah 66 maka kecepatan putaran mesin cuci adalah 938.333