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AI + ML Question 2

- 2 a) Fuzzy logic expert systems work by fuzzifying the input values into fuzzy membership functions, then perform the relevant rules in the rule set to calculate the fuzzy output functions, and finally de-fuzzifying the output functions to calculate the crisp output.

2 b) Mamdani-style inference and Sugeno fuzzy inference are two defuzzification techniques.

Sugeno fuzzy inference is more efficient computationally than Mamdani-style as it uses a function instead of a fuzzy set.

2 c) Power = 11
damage = 6

$$\mu_{\text{power}}^{\text{low}}(11) = \frac{15 - 11}{5} = \frac{4}{5} = \underline{0.8}$$

$$\mu_{\text{power}}^{\text{Med}}(11) = \frac{11 - 10}{5} = \frac{1}{5} = \underline{0.2}$$

$$\mu_{\text{power}}^{\text{high}}(11) = \underline{0}$$

$$\mu_{\text{damage}}^{\text{low}}(6) = \frac{7.5 - 6}{2.5} = \frac{1.5}{2.5} = \underline{0.6}$$

$$\mu_{\text{damage}}^{\text{high}}(6) = \frac{6 - 5}{5} = \frac{1}{5} = \underline{0.2}$$

2 c)
cont.

$$\begin{aligned}\mu_{\text{power}}^{\text{low}} &= 0.8 \\ \mu_{\text{power}}^{\text{med}} &= 0.2 \\ \mu_{\text{power}}^{\text{high}} &= 0\end{aligned}$$

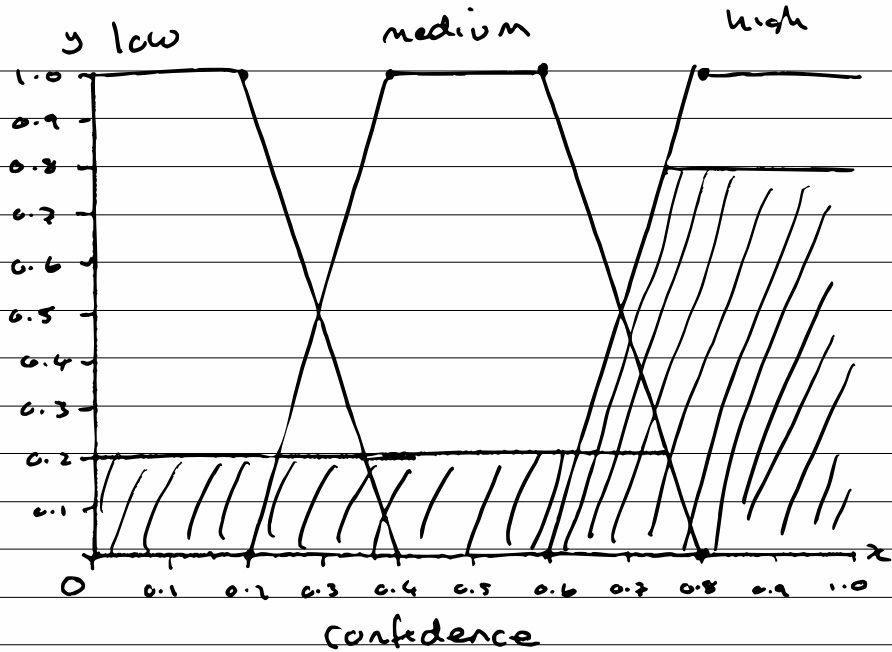
$$\begin{aligned}\mu_{\text{damage}}^{\text{low}} &= 0.6 \\ \mu_{\text{damage}}^{\text{high}} &= 0.2\end{aligned}$$

$$\text{low confidence} = \max|0, 0.2| = \underline{0.2}$$

$$\text{medium confidence} = \min|0.2, 0.6| = \underline{0.2}$$

$$\text{high confidence} = \underline{0.8}$$

2 c)
Cont



x	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
low	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Med	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0
high	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.8	0.8	0.8
result	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.8	0.8	0.8

$$COG = \frac{0.2(0.0 + 0.1 + 0.2 + 0.3 + 0.4 + 0.5 + 0.6) + 0.5(0.7) + 0.8(0.8 + 0.9 + 1.0)}{0.2(7) + 0.5(1) + 0.8(3)}$$

$$= \frac{0.42 + 0.35 + 2.16}{1.4 + 0.5 + 2.4}$$

$$= \frac{2.91}{4.30} = \underline{\underline{0.677}}$$

[illegible]