

1. a. Using your own intuition, develop fuzzy membership functions on the real line for the fuzzy number 5, using the following function shapes:
 - (a) symmetric triangle
 - (b) trapezoid
 - (c) Gaussian function.
- b. For the data shown in the accompanying Table A, show the first two iterations using a genetic algorithm in trying to find the optimum membership functions (use right-triangle functions) for the input variable x and output variable y in the rule table, Table B.

TABLE A

Data.			
x	0	45	90
y	0	0.71	1

TABLE B

Rules.		
x	SM	MD
y	SM	LG

For the rule table, the labels SM, MD, and LG mean small, medium, and large, respectively.

2. a. What are the criterion normally used to measure defuzzification? 3 + 7
- b. Often, in chemical processing plants, there will be more than one type of instrumentation measuring the same variable at the same instance during the process. Owing to the nature of measurements, they are almost never exact, and hence can be represented as a fuzzy set. Owing to the differences in instrumentation, the measurements will usually not be the same. Take, for example, two types of temperature sensors, namely, a thermocouple (TC) and a resistance temperature detector (RTD) measuring the same stream temperature. The membership function of the two types of temperature sensors may look as in Figure P4.14.

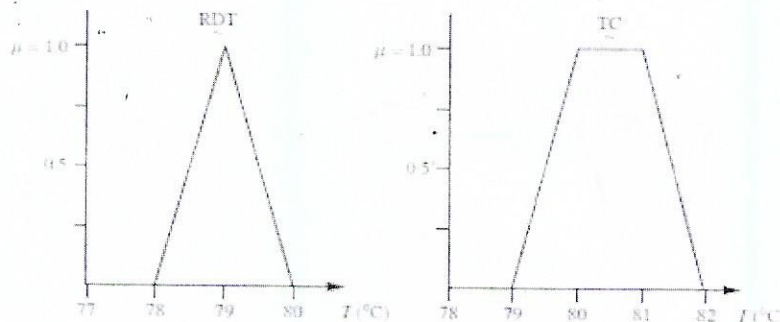


FIGURE P4.14

FIGURE P4.14 When an operator who prefers one measuring device ends his or her shift, and then is replaced by another operator with a different preference in measuring device, there may be a problem in determining the actual value of a variable. To avoid this problem, it was decided to plot the membership functions of the two types of sensors, take their union, and employ defuzzification to select one temperature for the operator to use. To find this temperature, for each of the seven methods presented in this chapter, assess (a) whether each is applicable and, if so, (b) calculate the defuzzified value, z^* .

- c. Two fuzzy relations are given by

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$$\begin{array}{|c|c|c|} \hline 0.4 & 0.6 & 0 \\ \hline 0.9 & 1 & 0.1 \\ \hline \end{array} \quad \begin{array}{|c|c|} \hline 0.5 & 0.8 \\ \hline 0.1 & 1 \\ \hline 0 & 0.6 \\ \hline \end{array}$$

Obtain fuzzy relations $R \circ S$ as Max-Product composition composition between these two fuzzy relations.

3. Why is fuzzy logic leading to more human intelligent machines? 2
4. What are the component of fuzzy inference system? 2
5. What are the difference between fuzzy membership and probability value? 2