

Q1

- i. Draw membership functions (and hence define fuzzy sets) that quantifies the sets of all people of medium height, tall and short.
- ii. Draw a membership function that quantifies the statement "the number x is near 10."
- iii. Draw a membership function that quantifies the statement "the number x is greater than 10."

Q2.

Let X be the universe of military aircraft of interest, as defined below:

$$X = \{a10, b52, b117, c5, c130, f4, f14, f15, f16, f111, kc130\}$$

Let A be the fuzzy set of bomber class of aircraft:

$$A = \{0.2/f16 + 0.4/f4 + 0.5/a10 + 0.5/f14 + 0.6/f15 + 0.8/f111 + 1.0/b117 + 1.0/b52\}$$

Let B be the fuzzy set of fighter class aircraft:

$$B = \{0.1/b117 + 0.3/f111 + 0.5/f4 + 0.8/f15 + 0.9/f14 + 1.0/f16\}$$

Find the following various standard set combinations for these two sets:

(a) $A \cup B$

(b) $A \cap B$

(c) \overline{A}

(d) \overline{B}

- Q3.** Suppose we have a crisp set $A = \{0/-2 + 0/-1 + 1/0 + 1/1 + 0/2\}$ defined on the universe $X = \{-2, -1, 0, 1, 2\}$, and a mapping $y = |4x| + 2$. Find the crisp set B on an output universe Y using Zadeh's extension principle.

- Q4.** Find the projections on to the X and Y dimension of the following fuzzy relation P.

$$P = \begin{pmatrix} 0.1 & 0.5 & 0.4 & 0.2 \\ 0 & 0.7 & 0.7 & 0.6 \\ 0.3 & 0.4 & 0.6 & 0.3 \\ 0.5 & 0.5 & 0.5 & 0.5 \\ 0.3 & 0.6 & 0.2 & 0.9 \end{pmatrix} \subseteq X \times Y$$

Find the cylindrical extensions of the two projections. Show that P is contained in the intersection of the cylindrical extensions.