Q1 Answer the following (3 only):
   a) Define fuzzy logic, what are its basic applications?
   b) Give difference between fuzzy logic and two valued logic?
   c) Define FLC, the FLC is useful in two cases what are they?
   d) What are the basic differences between classical rules and fuzzy rules?  

(15 mark)

Q2 Answer the following(5 only):
   a) A set that has no element is called an -----------.
   b) If A = {a, b, c}, then |A| = ---------, the power set P(A)= -------------- , and |P(A)|=-------------
   c) The complement of an empty set is ---------------.
   d) When two sets A and B have nothing in common, the relation is called ----------.
   e) Crisp membership function maps the element of the universal set X to the set -----------.
   f) In fuzzy sets, each elements is mapped to -----------.
   g) The membership degree of fuzzy cardinality= --------------.
   h) Let A = (1, 5, 6, 9), B = (2, 3, 5, 8), A(+) B = --------------, A (-) B = -----------.
   i) Let A = {1/a, 0.3/b, 0.2/c 0.8/d, 0/e}, find A₀₅= -----------.

(15 mark)

Q3 Answer the following:
   a) Compute Hamming distance; Euclidean distance, Minkowski distance with w=2, of the sets
      \[ A = \{ (x₁, 0.4), (x₂, 0.8), (x₃, 1), (x₄, 0) \}, \quad B = \{ (x₁, 0.4), (x₂, 0.3), (x₃, 0), (x₄, 0) \} \]

   b) Compute the simple disjunctive sum, disjoint sum, simple difference, and bounded difference
      of the sets
      \[ A = \{ (x, 0.5), (y, 0.4), (z, 0.9), (w, 0.1) \}, \quad B = \{ (x, 0.4), (y, 0.8), (z, 0.1), (w, 1) \} \]

(15 mark)

Q4 Answer the following:
   a) Define linguistic variable? What are the fuzzy linguistic variable basic parts? Define
      components for the linguistic variable X whose name is temperature?
   b) Determine the truth value of the following propositions P1 and P2:
      \[ P₁ = "P is very true", \quad P₂ = "P is false", \quad P = "30 is high", \quad \mu_{\text{very true}} = (\mu_{\text{true}})^2 \]

(15 mark)

Q5 Answer the following:
   a) Describe the process of decomposition fuzzy rule base?
   b) Given 'if temperature is high, then humidity is fairly high', and
      \[ T, H \quad \text{universes}, \quad t, h \quad \text{variables} \quad t \in T, \quad h \in H \]
      \[ A =\text{'high'} \quad A \subseteq T \]
      \[ B =\text{'fairly high'} \quad B \subseteq H \]
      \[
      \begin{array}{c|c|c|c}
      t & 20 & 30 & 40 \\
      \hline
      \mu_{A}(t) & 0.1 & 0.5 & 0.9 \\
      \end{array}
      \quad
      \begin{array}{c|c|c|c|c}
      h & 20 & 50 & 70 & 90 \\
      \hline
      \mu_{B}(h) & 0.2 & 0.6 & 0.7 & 1 \\
      \end{array}
      \]
      Apply mamdani method to find implication between A and B.

(10 mark)