Q1 Consider two fuzzy subsets of the set X, \( X = \{ a, b, c, d, e \} \) referred to as A and B
\[ A = \{ 1/a, 0.3/b, 0.2/c, 0.8/d, 0/e \} \quad \text{and} \quad B = \{ 0.6/a, 0.9/b, 0.1/c, 0.3/d, 0.2/e \} \]
Find
1) support 2) core 3) cardinality 4) complement, 5) union, 6) intersection 7) \( \alpha \)-cut for each set where \( \alpha = 0.5 \), and \( \alpha = 0.3 \)

Q2 a) What are the basic conditions that the fuzzy expression should satisfy to be a fuzzy logic.
b) What is the difference between Triangular fuzzy number and Trapezoidal fuzzy number?
c) Describe with example the four methods of expressing the relation between sets A and B.

Q3 a) Compute the simple disjunctive sum, disjoint sum, simple difference, and bounded difference of the sets:
\[ A = \{ (x, 0.5), (y, 0.4), (z, 0.9), (w, 0.1) \} \]
\[ B = \{ (x, 0.4), (y, 0.8), (z, 0.1), (w, 1) \} \]

b) Evaluate the following fuzzy logic formula \( P \rightarrow Q \), \( P \wedge (P \rightarrow Q) \), \( P \wedge (P \rightarrow Q) \rightarrow Q \), where \( P = 1 \) and \( Q = 0 \)

Q4 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”, P2 = “P is false”, where P = “30 is high”, the truth value of P is 0.3, \( \mu_{\text{very true}} = (\mu_{\text{true}})^2 \)

Q5 Consider a fuzzy set A and a crisp set B:
\[ A = \{ (x, 0.4), (y, 0.9), (z, 1.0), (w, 0.1) \} \quad \text{B} = \{ a, b, c \} \]
Determine a fuzzy set \( B' \subseteq B \) induced by A and the relation \( R \subseteq A \times B \)

<table>
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<th>R</th>
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<th>b</th>
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Q6 Define FLC, the FLC is useful in two cases what are they? What are the advantages of FLC, Describe FLC architecture?

Q7 There is a fuzzy rule, \( R : \text{if } u \text{ is } A \text{ and } v \text{ is } B \text{ then } w \text{ is } C \), where \( A = (0, 2, 4) \), \( B = (3, 4, 5) \) and \( C = (3, 4, 5) \)
a) Find inference result \( C' \) when input is \( u = 3 \), \( v = 4 \) by using Larsen method.
b) Find inference result \( C' \) when input is \( A = (0, 1, 2) \) and \( B = (2, 3, 4) \) by using Larsen method.