Assignment-1

Q.1 Find the power set and cardinality of the given set X = {2, 4, 6}. Also find cardinality of power set.

Q.2 Consider two given fuzzy sets

A= {(2, 1), (4, 0.3) (6, 0.5) (8, 0.2)}
B= {(2, 0.5), (4, 0.4) (6, 0.1) (8, 1)}
Perform union, intersection, difference, and complement over fuzzy sets A and B.

Q.3 Given the two fuzzy sets:

A1={(1,1),(1.5,0.75),(2,0.3),(2.5,0.15),(3,0)}
A2={(1,1),(1.5,0.6),(2,0.2),(2.5,0.1),(3,0)}

Find the following:

a) $A1 \cup A2$ b) $A1 \cap A2$ c) $\overline{A1}$ d) $\overline{A2}$ e) $A1|A2$ f) $\overline{A1 \sqcup A2}$ g) $\overline{A1 \sqcap A2}$

h) $A1 \cap \overline{A1}$ i) $A1 \cup \overline{A1}$ j) $A2 \cap \overline{A2}$ k) $A2 \cup \overline{A1}$

Q. 4. It is necessary to compare two sensors based upon their detection levels and gain settings. The table of gain settings and sensor detection levels with a standard item being monitored providing typical membership values to represent the detection levels for each sensor is given in Table 1.

Gain Setting	Detection level of sensor 1	Detection level of sensor 2
0	0	0
10	0.2	0.35
20	0.35	0.25
30	0.65	0.8
40	0.85	0.95
50	1	1

Now given the universe of discourse X = {0, 10, 20, 30, 40, 50} and the membership functions for the two sensors in discrete form as

D1=$\{\frac{0}{0}+\frac{0.2}{10}+\frac{0.35}{20}+\frac{0.65}{30}+\frac{0.85}{40}+\frac{1}{50}\}$

D2=$\{\frac{0}{0}+\frac{0.35}{10}+\frac{0.25}{20}+\frac{0.8}{30}+\frac{0.95}{40}+\frac{1}{50}\}$

Find the following membership Functions:

a) $\mu_{D1 \cup D2}(x)$ b) $\mu_{D1 \cap D2}(x)$ c) $\mu_{\overline{D1}}(x)$ d) $\mu_{\overline{D2}}(x)$ e)$\mu_{D_1 \cup \overline{D2}}$ f) $\mu_{D_1 \cap \overline{D2}}$

Q. 5 Consider two fuzzy sets

A= $\{\frac{0.2}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.5}{4}\}$

B= $\{\frac{0.1}{1} + \frac{0.2}{2} + \frac{0.2}{3} + \frac{1}{4}\}$

Find the algebraic sum, algebraic product, bounded sum and bounded difference of the given fuzzy sets.

Q.6 Consider two membership functions as follows:

For fuzzy set A, $\mu_A(x) = \left|\frac{60-x}{8}\right| + 1$ and for fuzzy set B, $\mu_B(x) = \left|\frac{40-x}{8}\right| + 1$

Find the following:

a) AUB b) $A \cap B$ c) $\bar{A}$ d) $\bar{B}$ e) $\overline{AUB}$ f) $\overline{A \cap B}$

Q.7 The elements in two sets A and B are given as

A = {2,4} B ={a,b,c}

Find the various Cartesian products of these two sets.

Q.8 Consider the following two fuzzy sets:

$A = \left\{\frac{0.3}{x_1} + \frac{0.7}{x_2} + \frac{1}{x_3}\right\}$ B = $\{\frac{0.4}{Y_1} + \frac{0.9}{Y_2}\}$ Perform the Cartesian product over these given fuzzy sets.

Q.9 Two fuzzy relations are given by R= $\begin{bmatrix} 0.6 & 0.3 \\ 0.2 & 0.9 \end{bmatrix}$ and S = $\begin{bmatrix} 1 & 0.5 & 0.3 \\ 0.8 & 0.4 & 0.7 \end{bmatrix}$

R define the relation between x1, x2 and y1 and y2 and S define the relation between y1, y2 and z1, z2, z3.

Obtain fuzzy relation T as a composition between the fuzzy relations R and S as:

1) Max-min composition 2) Max-product composition

Q.10 Using the inference approach, find the membership values for the triangular shapes I, R, E, IR, and T for a triangle with angle 45^0, 55^0 and 80^0.