SOFT COMPUTING LABORATORY

LAB MANUAL

Academic Year	**:**	**2018 -2019**
Course Code	**:**	**BCS208**
Regulations	**:**	**IARE -R18**
Semester	**:**	**II**
Branch	**:**	**CSE**

PreparedBy

Ms. K Sai Saranya

Assistant Professor

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad – 500 043

1. PROGRAM OUTCOMES:

M.TECH-PROGRAM OUTCOMES(POS)	
PO1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions
PO2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools
PO3	Demonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.
PO4	Write and present a substantial technical report/document
PO5	Independently carry out research/investigation and development work to solve practical problems
PO6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables
PO7	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.

2. PROGRAM SPECIFIC OUTCOMES:

PROGRAM SPECIFIC OUTCOMES(PEO's)	
PEO1	Independently design and develop computer software systems and products based on sound theoretical principles and appropriate software development skills.
PEO2	Demonstrate knowledge of technological advances through active participation in life-long
PEO3	Accept to take up responsibilities upon employment in the areas of teaching, research,and software development.
PEO4	Exhibit technical communication, collaboration and mentoring skills and assume rolesboth as team members and as team leaders in an organization.

3. ATTAINMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

S. No	Experiment	Program Outcomes Attained
1	Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights	PO1
2	Write a program to implement artificial neural network without back propagation. Write a program to implement artificial neural network with back propagation.	PO2
3	Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.	PO3
4	Implement travelling sales person problem (tsp) using genetic algorithms.	PO4
5	Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.	PO4
6	Implement linear regression and multi-regression for a set of data points	PO5
7	Implement crisp partitions for real-life iris dataset	PO5
8	Write a program to implement Hebb's rule Write a program to implement Delta rule.	PO7
9	Write a program to implement logic gates.	PO4
10	Implement svm classification by fuzzy concepts.	PO3

SYLLABUS:

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB19	Core	0	0	4	2	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Understand Fuzzyconcepts
II. Learn neural networks with back propagation and withoutpreparation
III. Learn the operators of geneticalgorithms
IV. Practice on crisppartitions

LIST OF EXPERIMENTS

Week-1	**PERCEPTRON**

Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights

Week-2	**ARTIFICIAL NEAURAL NETWORKS**

Write a program to implement artificial neural network without back propagation.
Write a program to implement artificial neural network with back propagation.

Week-3	**FUZZY SETS**

Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.

Week-4	**GENETIC ALGORITHMS**

Implement travelling sales person problem (TSP) using genetic algorithms.

Week-5	**COVARIANCE**

Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

Week-6	**DATA FITTING BY REGRESSION**

Implement linear regression and multi-regression for a set of data points.

Week-7	**CRISP MODEL**

Implement crisp partitions for real-life iris dataset.

Week-8	**PERCEPTRON RULE**

Write a program to implement Hebb's rule Write a program to implement Delta rule.

Week-9	LOGIC GATES
Write a program to implement logic gates.	
Week-10	**CLASSIFICATION**
Implement SVM classification by Fuzzy concepts.	

Reference Books:

D.K Prathikar, “Soft Computing”, Narosa Publishing House, New Delhi, 2008.

Web References:

1. https://ldrp.ac.in/images/syllabus/BE-Computer/802-3%20soft%20computing.pdfhttp://itmgoi.in/download/CSE%20&%20IT/Soft%20Computing%20IT%20(IT-802).pdf
2. http://mirlab.org/jang/book/

SOFTWARE AND HARDWARE REQUIREMENTS FOR 18 STUDENTS:
SOFTWARE: Python
HARDWARE: 18 numbers of Intel Desktop Computers with 4 GB RAM

INDEX

WEEK-1

DESCRIPTION: Write a program of Perceptron Training Algorithm.

Algorithm :

Start with a randomly chosen weight vector w0;
Let k=1;
While these exists input vector that are misclassified by: Wk-1 do
Let i be a misclassified input vector
Let Xk=class(ij)ij, impling that Wk-1.Xk<0
Update the weight vector to Wk= Wk-1 + nXk;
increment k;
End while;

Program :

```
#include<conio.h>
#include<iostream.h>
Void main( ) {
clrscr( );
int in[3],d,w[3],a=0;
for(inti=0;i<3,i++)
{
cout<<"\n initialize the weight vector w"<<i;
cin>>w[i] }
for(i=0;i<3:i++}
{
cout<<"\n enter the input vector i"<<i;
cin>>in[i];
}
cout<<"\n enter the desined output";
cin>>d;
intans=1;
while(ans= = 1)
{
for (a= 0, i==0;i<3;i++)
{
a = a + w[i] * in[i];
}
clrscr( );
cout<<"\n desired output is"<<d;
cout<<"\n actual output is "<<a;
int e;
e=d-a;
cout<<"\n error is "<<e;
cout<<"\n press 1 to adjust weight else 0";
cin>>ans;
if (e<0)
{
for(i=0;i<3;i++)
{
w[i]=w[i]-1;
```

```
}
else if (e>0)
{
for(i=0;i<3:i++)
{
w[i]=w[i]+1;
}
}
}
getch( );

}
```

OUTPUT:
Desire output is 2
Actual output is 17
Error is -15
Press 1 to adjust weight else 0

WEEK-2

DESCRIPTION: Write a program for Back Propagation Algorithm

PROGRAM:

```
# include <iostream.h>
#include <conio.h>
void main ()
{
inti ;
float delta, com, coeff = 0.1;
struct input
{
floatval,out,wo, wi;
int top;
} s[3] ;
cout<< "\n Enter the i/p value to target o/p" << "\t";
for (i=0; i<3 ; i++)
cin>> s [i], val>> s[i], top);
i = 0;
do
{
if (i = = 0)
{
W0 = -1.0;
W1 = -0.3;
}
else
{
W0 = del [i - 1], W0 ;
W1 = del [i - 1] , Wi ;
}
del [i]. aop = w0 + (wi * del [i]. val);
del [i].out = del [i]. aop);
delta = (top – del [i]. out) * del [i].out * (1 – del [i].out);
corr = coeff * delta * del [i].[out];
del [i].w0 = w1 + corr;
del [i]. w1 = w1 + corr;
i++;
}While ( i ! = 3)
cout<< "VALUE"<<"Target"<<"Actual"<<"w0" <<"w1"<<'\n;
for (i=0; i=3; i++)
{
cout<< s [i].val<< s[i].top<<s[i].out << s[i]. w0<< s[i]. w1;
cout<< "\n";
}
getch ();
}
```

OUTPUT:

Back Propagation network

1. **Load data**
2. **Learn from the data**
3. **Compute output pattern**
4. **Make new data file**
5. **Save data**
6. **Print data**
7. **Change learning rate**
8. **Exit**

Enter your Choice (1-8)

WEEK-3

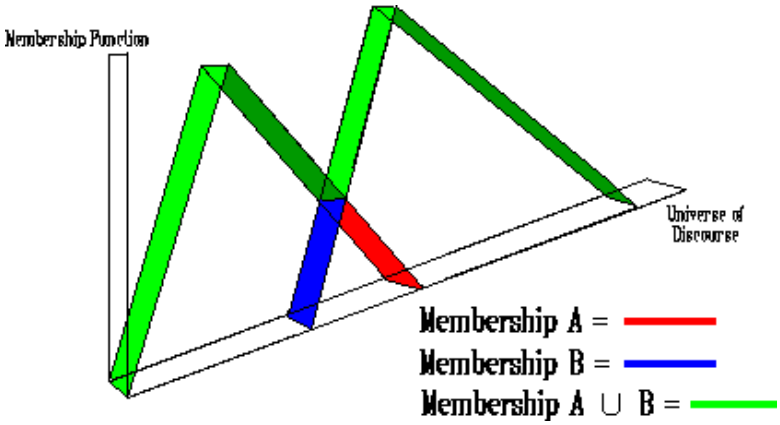
Fuzzy Logic:

Fuzzy logic is an organized method for dealing with imprecise data. It is a multivalued logic that allows intermediate values to be defined between conventional solutions. In classical set theory, the membership of elements in a set is assessed in binary terms according to a bivalent condition — an element either belongs or does not belong to the set. By contrast, fuzzy set theory permits the gradual assessment of the membership of elements in a set; this is described with the aid of a membership function valued in the real unit interval [0, 1]. Bivalent Set Theory can be somewhat limiting if we wish to describe a 'humanistic' problem mathematically.

1. ***Union:***

Union of twofuzzysetsisdenotedas

$$\mu_{A\cup B}(x) = \max\left(\mu_A(x), \mu_B(x)\right)$$

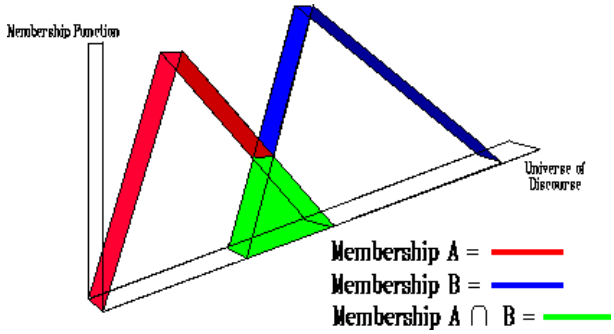


Example

$$\tilde{A} \cup \tilde{B} = \{(x_1, 0.4), (x_2, 0.7), (x_3, 1), (x_4, 0.2)\}$$

2. ***Intersection***

Union of two fuzzysets$\tilde{A}$andBis denoted by$\tilde{A} \cap \tilde{B}$andisdefined as,



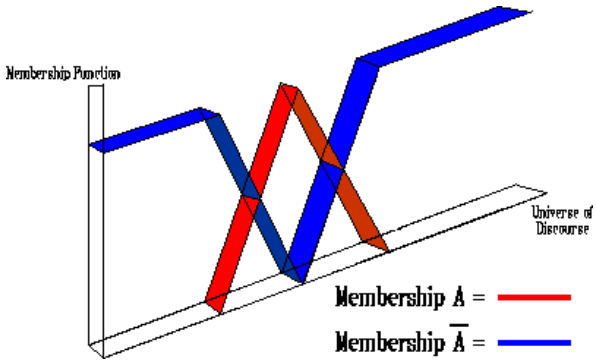
$$\mu_{A\cap B}(x) = \min\left(\mu_A(x), \mu_B(x)\right)$$

Example $\tilde{A} \cap \tilde{B} = \{(x_1, 0.1), (x_2, 0.3), (x_3, 1), (x_4, 0)\}$

3) Compliment

Complementof a fuzzyset$\tilde{A}$denoted by$\widetilde{A^c}$andis defined as,

Example $\widetilde{A^c} = \{(x_1, 0.9), (x_2, 0.3), (x_3, 0), (x_4, 1)\}$



Implementation of fuzzy relations (Max-MinComposition)

Consider two fuzzy relation; R (X ×Y) and S (Y ×Z), then a relation T (X × Z), can be expressed asmax-mincomposition

T = R o S

μT (x, z) = max-min [μR (x, y), μS (y, z)]= V [μR (x, y) ^ μS (y, z)]

If algebraic product is adopted, then max-product compositionisadopted:

T = R o S

μT (x, z) = max [μR (x, y) . μS (y, z)]= V [μR (x, y) . μS (y, z)]

The max-min composition can be interpreted as indicating the strength of the existence of relation between the elements of X and Z.Calculations of (R o S) are almost similar to matrixmultiplication.

Max-Min Composition:

Let X,Y and Z be universal sets and let R and Q be relations that relate them as,

$$R = \{(x, y) | x \in X, y \in Y, R \subset X \times Y\}$$

$$Q = \{(y, z) | y \in Y, z \in Z, Q \subset Y \times Z\}$$

Then S will be a relation that relates elements of X with elements of Z as,

$$S = R \circ Q$$

$$S = \{ (x, z) | x \in X, z \in Z, S \subset X \times Z$$

Max min composition is then defined as,

WEEK-4

Description: Implement Travelling sales person using genetic Algorithm

PROGRAM:

```
importjava.util.*;
importjava.text.*;
class TSP
{
int weight[][],n,tour[],finalCost;
finalint INF=1000;
public TSP()
{
Scanner s=new Scanner(System.in);
System.out.println("Enter no. of nodes:=>");
n=s.nextInt();
weight=new int[n][n];
tour=new int[n-1];
for(inti=0;i<n;i++)

{
for(int j=0;j<n;j++)
{
if(i!=j)
{
System.out.print("Enter weight of "+(i+1)+" to "+(j+1)+":=>");
weight[i][j]=s.nextInt();
}
}
}
System.out.println();
System.out.println("Starting node assumed to be node 1.");
eval();
}
publicint COST(intcurrentNode,intinputSet[],intsetSize)
{
if(setSize==0)
return weight[currentNode][0];
int min=INF,minindex=0;
intsetToBePassedOnToNextCallOfCOST[]=new int[n-1];
for(inti=0;i<setSize;i++)
{
int k=0;//initialise new set
for(int j=0;j<setSize;j++)
{
if(inputSet[i]!=inputSet[j])
setToBePassedOnToNextCallOfCOST[k++]=inputSet[j];
}
int temp=COST(inputSet[i],setToBePassedOnToNextCallOfCOST,setSize-1);
```

```
if((weight[currentNode][inputSet[i]]+temp) < min)
{
min=weight[currentNode][inputSet[i]]+temp;
minindex=inputSet[i];
}
}
return min;
}
publicint MIN(intcurrentNode,intinputSet[],intsetSize)
{
if(setSize==0)
return weight[currentNode][0];
int min=INF,minindex=0;
intsetToBePassedOnToNextCallOfCOST[]=new int[n-1];
for(inti=0;i<setSize;i++)//considers each node of inputSet
{
int k=0;
for(int j=0;j<setSize;j++)
{
if(inputSet[i]!=inputSet[j])
setToBePassedOnToNextCallOfCOST[k++]=inputSet[j];
}
int temp=COST(inputSet[i],setToBePassedOnToNextCallOfCOST,setSize-1);
if((weight[currentNode][inputSet[i]]+temp) < min)
{
min=weight[currentNode][inputSet[i]]+temp;
minindex=inputSet[i];
}
}
returnminindex;
}
public void eval()
{
intdummySet[]=new int[n-1];
for(inti=1;i<n;i++)
dummySet[i-1]=i;
finalCost=COST(0,dummySet,n-1);
constructTour();
}
public void constructTour()
{
intpreviousSet[]=new int[n-1];
intnextSet[]=new int[n-2]; for(inti=1;i<n;i++)
previousSet[i-1]=i;
intsetSize=n-1;
tour[0]=MIN(0,previousSet,setSize);
for(inti=1;i<n-1;i++)
{
int k=0;
for(int j=0;j<setSize;j++)
{
if(tour[i-1]!=previousSet[j])
```

```
nextSet[k++]=previousSet[j];
}
--setSize;
tour[i]=MIN(tour[i-1],nextSet,setSize);
for(int j=0;j<setSize;j++)
previousSet[j]=nextSet[j];
}
display();
}
public void display()
{
System.out.println();
System.out.print("The tour is 1-");
for(inti=0;i<n-1;i++)
System.out.print((tour[i]+1)+"-");
System.out.print("1");
System.out.println();
System.out.println("The final cost is "+finalCost);
}
}
classTSPExp
{
public static void main(String args[])
{
TSP obj=new TSP();
}
}
```

OUTPUT :

```
Enter no. of nodes:=>
5
Enter weight of 1 to 2:=>4
Enter weight of 1 to 3:=>6
Enter weight of 1 to 4:=>3
Enter weight of 1 to 5:=>7
Enter weight of 2 to 1:=>3
Enter weight of 2 to 3:=>1
Enter weight of 2 to 4:=>7
Enter weight of 2 to 5:=>4
Enter weight of 3 to 1:=>7
Enter weight of 3 to 2:=>4
Enter weight of 3 to 4:=>3
Enter weight of 3 to 5:=>6
Enter weight of 4 to 1:=>8
Enter weight of 4 to 2:=>5
Enter weight of 4 to 3:=>3
Enter weight of 4 to 5:=>2
Enter weight of 5 to 1:=>4
Enter weight of 5 to 2:=>3
Enter weight of 5 to 3:=>2
Enter weight of 5 to 4:=>1


Starting node assumed to be node 1.
The tour is 1-2-3-4-5-1
The final cost is 14
```

WEEK-5

COVARIANCE

Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

PROBLEM DEFINATION:

a) Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.

SOURCE CODE:

```
Image(x=seq(dim(x)[2])
  Y<-seq(dim(y)[2])
  Z=COR,xlab=”xcolumn”,ylab=”y column”)
  Library(gtlcharts)
  Data(iris)
  Iris$species<-NULL
  Iplotcorr(iris,reoder=TRUE
```

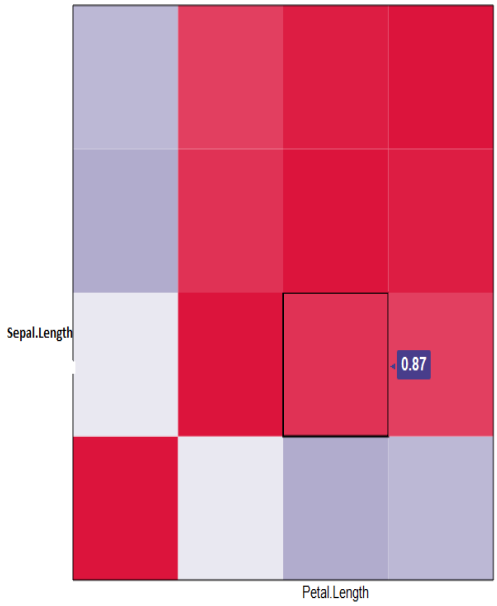
PROBLEM DEFINATION:

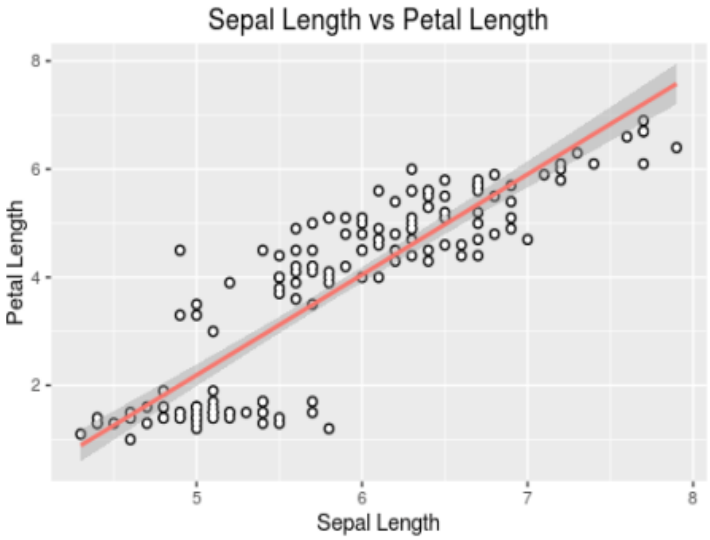
b) Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

SOURCE CODE:

```
library(ggplot2)
data(iris)
str(iris)
ggplot(data=iris,aes(x=sepal.length,y=petal.length))+geom_point(size=2,colour=”black”)+geom_
point(size=1,colour=”white”)+geom_smooth(aes(colour=”black”),method=”lm’)+ggtitle(“sepal.le
ngthvspetal.length”)+xlab(“sepal.length”)+ylab(“petal.length”)+these(legend.position=”none”)
```

output:


Sepal.Length
0.87
Petal.Length


Sepal Length vs Petal Length
Petal Length
8
6
4
2
5
6
7
8
Sepal Length

WEEK- 6

DATA FITTING BY REGRESSION

PROBLEM DEFINATION

Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.

SOURCE CODE:

```
>mydata$rank<-factor(mydata$rank)
>mylogit<-glm(admit~gre+gpa+rank,data=mydata,family=”binomial”)
>summary(mylogit)
```

OUTPUT:

```
> mydata$rank <- factor(mydata$rank)
> mylogit <- glm(admit ~ gre + gpa + rank, data = mydata, family = "binomial")
> summary(mylogit)

Call:
glm(formula = admit ~ gre + gpa + rank, family = "binomial",
    data = mydata)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.6268  -0.8662  -0.6388   1.1490   2.0790

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -3.989979   1.139951  -3.500 0.000465 ***
gre          0.002264   0.001094   2.070 0.038465 *
gpa          0.804038   0.331819   2.423 0.015388 *
rank2       -0.675443   0.316490  -2.134 0.032829 *
rank3       -1.340204   0.345306  -3.881 0.000104 ***
rank4       -1.551464   0.417832  -3.713 0.000205 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 499.98  on 399  degrees of freedom
Residual deviance: 458.52  on 394  degrees of freedom
AIC: 470.52

Number of Fisher Scoring iterations: 4
```

WEEK-7

DESCRIPTION: STUDY AND ANALYSIS OF CRISP LOGIC.

CRISP LOGIC :-

In older days, Crisp logic were used to handle the problem of binary value ie. 0 and 1.

Crisp logic is also known as traditional, conventional or binary logic.

Crisp logic have two valued logic first is true and other is false. Crisp logic is based on the reasoning which is exact and fixed. It is based on the logic of completely true and completely false.

We can defined completely true as one (1) and completely false as zero (0).

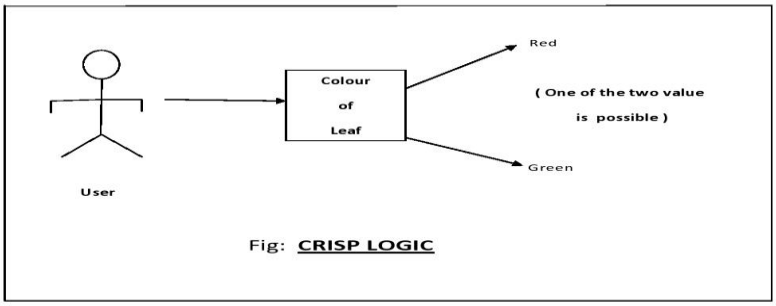


Fig: CRISP LOGIC

PROGRAM:

```
importnet.sourceforge.jFuzzyLogic.FIS;
importnet.sourceforge.jFuzzyLogic.rule.FuzzyRuleSet;
/**
 * Test parsing an FCL file
 * @author pcingola@users.sourceforge.net
 */
public class TestTipper {
public static void main(String[] args) throws Exception {
        // Load from 'FCL' file
        String fileName = "fcl/tipper.fcl";
        FIS fis = FIS.load(fileName,true);
        // Error while loading?
if(fis == null ) {
System.err.println("Can't load file: '"
                                + fileName + "'");
return;
        }
```

```
 // Show
fis.chart();
        // Set inputs
fis.setVariable("service", 3);
fis.setVariable("food", 7)
// Evaluate
fis.evaluate();
        // Show output variable's chart
fis.getVariable("tip").chartDefuzzifier(true);
        // Print ruleSet
System.out.println(fis);
    }
}
```

Week -8

DESCRIPTION: Write a program to implement Hebb's rule

PROGRAM:

```
#include<<iostream.h>>
#include<<conio.h>>
void main()
{
floatn,w,t,net,div,a,al;
cout<<"consider o single neuron percetron with a single i/p";
cin>>w;
cout<<"enter the learning cofficient";
cin>>d;
for (i=0;i<10;i++)
{
net = x+w;
if(wt<0)
a=0;
else
a=1;
div=at+a+w;
w=w+div;
cout<<"i+1 in fraction are i"<<a<<"change in weight"<<dw<<"adjustment at="<<w;
}
}
```

OUTPUT:

Consider 0 single neuron perceptron with a single i/p1
Enter the learning Co-efficient 2
i+1 in fraction are i1change in weight2adjustment at 3i+1
In fraction are i1change in weigh4adjustment at i+1
In fraction are i1change in weight8adjustment at i= 15i+1
In fraction are i1change in weight16adjustment at=31i+1
In fraction are i1change in weight 32adjustment at=63i+1
In fraction are i1change in weight 64adjustment at=127i+1
In fraction are i1change in weight 128adjustment at=255i+1
In fraction are i1change in weight 256adjustment at=511i+1
In fraction are i1change in weight 512adjustment at=1023i+1
In fraction are i1change in weight 1024adjustment at=2047i+1
Consider 0 single neuron perceptron with a single i/p

DESCRIPTION: Write a program to implement of delta rule.

PROGRAM:

```
#include<<iostream.h>>
#include<<conio.h>>
void main()
{
clrscr( );
float input[3],d,weight[3],delta;
for(inti=0;i < 3 ; i++)
{
cout<<"\n initilize weight vector "<<i<<"\t";
cin>>input[i];
}
cout<<""\n enter the desired output\t";
cin>>d;
do
{
del=d-a;
if(del<0)
for(i=0 ;i<3 ;i++)
w[i]=w[i]-input[i];
else if(del>0)
for(i=0;i<3;i++)
weight[i]=weight[i]+input[i];
for(i=0;i<3;i++)
{
val[i]=del*input[i];
weight[+1]=weight[i]+val[i];
}
cout<<"\value of delta is "<<del;
cout<<"\n weight have been adjusted";
}while(del ≠ 0)
if(del=0)
cout<<"\n output is correct";
}
```

OUTPUT:

Initialize weight vector 1
Initialize weight vector 2
Initialize weight vector 3
Enter desired output

Week-9

DESCRIPTION: Write a program to implement logic gates.

PROGRAM:

```
#include <iostream>
int main()
{
char menu; //Menu control variable
int result; //final output variable
int dataValue1;
int dataValue2;
cout<< "enter your Boolean operator code: (A,O,N,X): ";
cin>> menu;
switch (menu) //Menu control variable
{
case 'A':
cout<< "Enter first Boolean value:";
cin>> dataValue1;
cout<< "Enter second Boolean value:";
cin>> dataValue2;
if(dataValue1 == 1 && dataValue2 == 1)
{
result = 1;
}
else
{
result = 0;
}
cout<< "show result:" << result;
break;
case 'O':
cout<< "Enter first Boolean value:";
cin>> dataValue1;
cout<< "Enter second Boolean value:";
cin>> dataValue2;
if(dataValue1 == 1 || dataValue2 == 1)
{
result = 1;
}else
{
result = 0;
}
cout<< "show result:" << result;
break;
case 'N':
cout<< "Enter first Boolean value:";
cin>> dataValue1;
```

```
result = !dataValue1;
cout<< "show result:" << result;
break;
case 'X':
cout<< "Enter first Boolean value:";
cin>> dataValue1;
cout<< "Enter second Boolean value:";
cin>> dataValue2;
if(dataValue1 = !dataValue1)
{
result = 1;
}else
{
result = 0;
}
cout<< "show result:" << result;
break;
default:
result = 0;
break;
}//end switch
cin.ignore(2);
return 0;
}//end main
```

OUTPUT:

```
Enter your Boolean operator code :(A,O,N,X) : A
Enter First Boolean value :1
Enter Second  Boolean value :1
Show Result :1
Enter your Boolean operator code :(A,O,N,X) : O
Enter First Boolean value :1
Enter Second  Boolean value :0
Show Result :1
```

WEEK-10

Description : SVM Classification

Program:

```
#include<iostream.h>
#include<conio.h>
Void main( ) {
clrscr( );
int in[3],d,w[3],a=0;
for(inti=0;i<3,i++)
{
cout<<"\n initialize the weight vector w"<<i;
cin>>w[i] }
for(i=0;i<3:i++}
{
cout<<"\n enter the input vector i"<<i;
cin>>in[i];
}
cout<<"\n enter the desined output";
cin>>d;
intans=1;
while(ans= = 1)
{
for (a= 0, i==0;i<3;i++)
{
a = a + w[i] * in[i];
}
clrscr( );
cout<<"\n desired output is"<<d;
cout<<"\n actual output is "<<a;
int e;
e=d-a;
cout<<"\n error is "<<e;
cout<<"\n press 1 to adjust weight else 0";
cin>>ans;
if (e<0)
{
for(i=0;i<3;i++)
{
w[i]=w[i]-1;}
}
else if (e>0)
{
for(i=0;i<3:i++)
{
w[i]=w[i]+1;
}
}
getch( );
}
```

OUTPUT:

Desired output is 2
Actual output is 17
Error is -15
Press 1 to adjust weight else 0