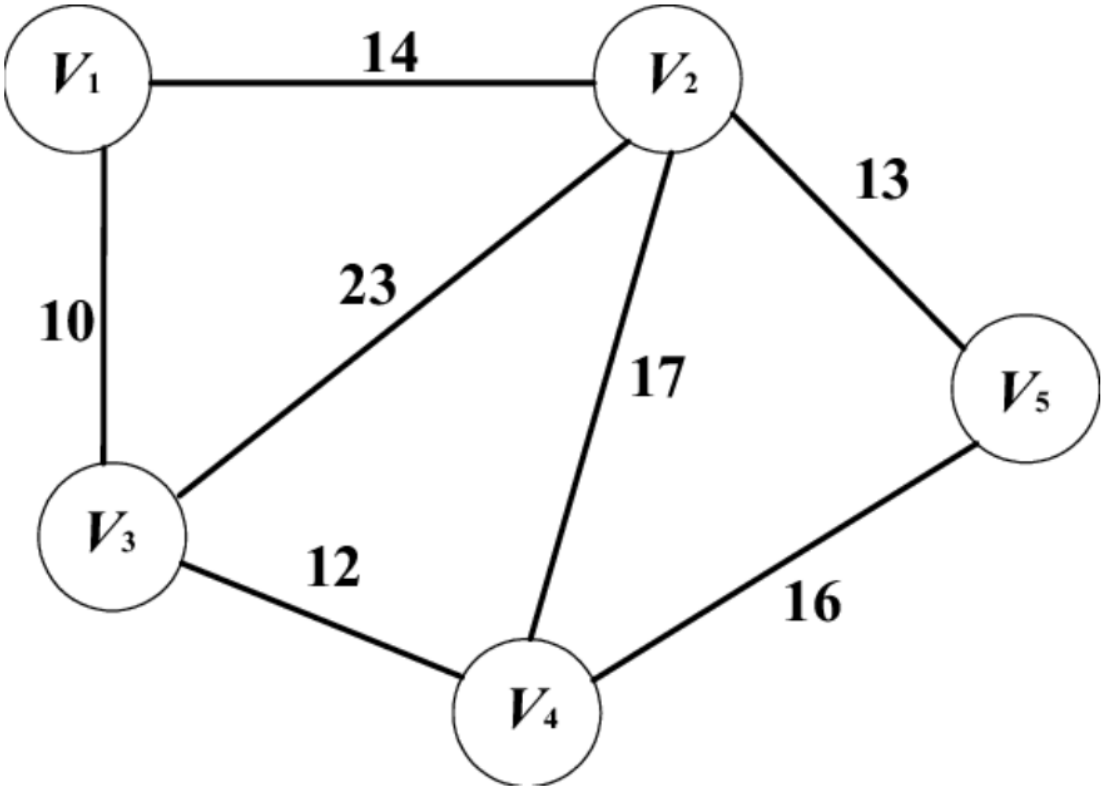
Candidate seat No: _____

Charotar University of Science and Technology [CHARUSAT]
Faculty of Technology and Engineering
U & P U. Patel Department of Computer Engineering
Subject: CE357 Artificial Intelligence
External Practical Examination

Semester: 6th Sem B. Tech. (CE) **Maximum Marks: 15**
Date: 12/04/2023 (Monday) **Time: 09:00 am to 04:20 pm**

Instructions:
(i) Attempt ***all*** the questions.
(ii) Figures to the right indicate ***full*** marks.
(iii) Make suitable assumptions and draw neat figures wherever if required.

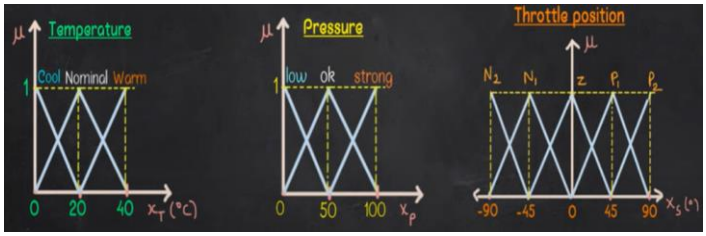
[1a] Write a prolog program to find all the paths between any two vertices in the given graph. Also find the shortest path between any two nodes of a graph if given weight on each node of a graph is as follows.



[1b] Design a simple fuzzy control system for a steam turbine using Online MATLAB. Assume the input of the fuzzy controller as temperature and pressure. The output will be the throttle setting of a steam turbine. Use 3 descriptors for input and 5 descriptors for output variables. Values for the variables are given below:
Temperature: Cool [0,20], Nominal [20,40] and Warm [20,40], Pressure: Low [0, 50], Ok [0,100] and Strong [50, 100], Throttle setting of steam turbine:
N2-Large Negative [-90, -45]
N1-Small Negative [-90,0]
Z-Zero [-45, 45]
P1-Small Positive [0,90]
P2-Large Positive [45,90]

Fuzzy Rule Base:

	LOW	OK	STRONG
COOL	P2	Z	N2
NOMINAL	P2	Z	N1
WARM	P1	N2	N1



a. Identify the input and output variables
b. Assign each fuzzy subset a linguistic variable or a descriptor
c. Obtain membership function for those descriptors
d. Form a fuzzy rule base
e. Fuzzification evaluate the rules

Perform Defuzzification: Assume that the current temperature is 30% and pressure is 40% and you have to determine the throttle position of the turbine for this particular condition.

[2a] Write down prolog program to **Construct a complete binary tree**

A *complete* binary tree with height H is defined as follows: The levels 1,2,3,...,H-1 contain the maximum number of nodes (i.e 2**(i-1) at the level i, note that we start counting the levels from 1 at the root). In level H, which may contain less than the maximum possible number of nodes, all the nodes are "left-adjusted". This means that in a level-order tree traversal all internal nodes come first, the leaves come second, and empty successors (the nil's which are not really nodes!) come last.

Particularly, complete binary trees are used as data structures (or addressing schemes) for heaps.

We can assign an address number to each node in a complete binary tree by enumerating the nodes in levelorder, starting at the root with number 1. In doing so, we realize that for every node X with address A the following property holds: The address of X's left and right successors are 2*A and 2*A+1, respectively, supposed the successors do exist. This fact can be used to elegantly construct a complete binary tree structure. Write a predicate complete_binary_tree/2 with the following specification:

% complete_binary_tree(N,T) :- T is a complete binary tree with N nodes. (+,?)

Test your predicate in an appropriate way.

[2b] Implement the following in the Orange tool:

Read the titanic dataset. Split the dataset into training and testing dataset [80:20].

Apply Logistic Regression, Tree Algorithm, Naïve Bayes Classification algorithm and compare classification performance result.

[3a] Write a prolog program to check **Graph isomorphism**

Two graphs G1(N1,E1) and G2(N2,E2) are isomorphic if there is a bijection f: N1 -> N2 such that for any nodes X,Y of N1, X and Y are adjacent if and only if f(X) and f(Y) are adjacent.

Write a predicate that determines whether two graphs are isomorphic.
Hint: Use an open-ended list to represent the function f.

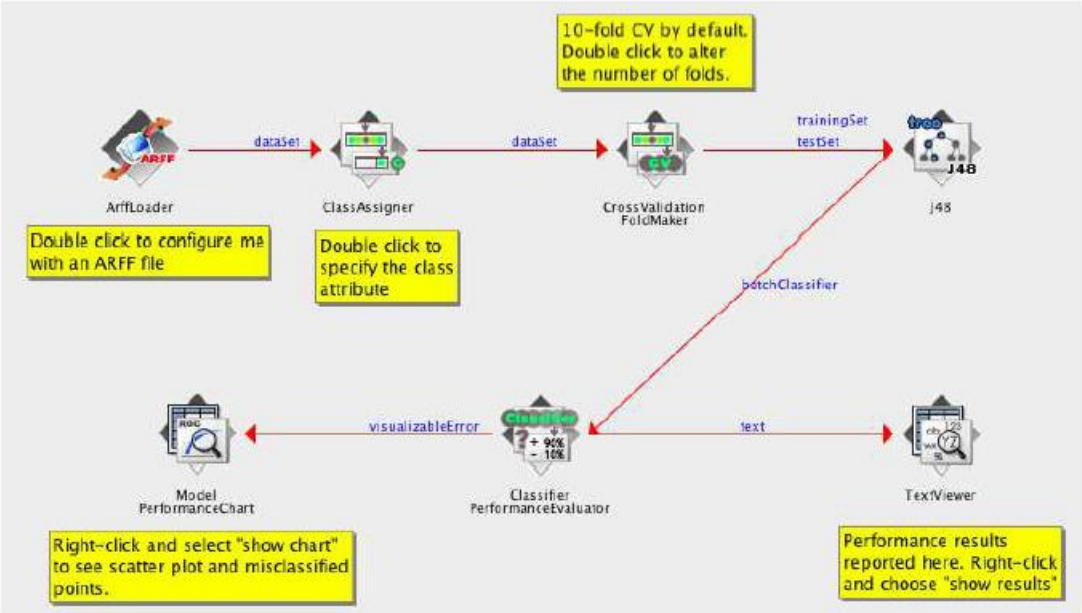
[3b] Show the uses of NEUROINTELLIGENCE to make prediction for faculty retention ratio with appropriate dataset. Also take one more dataset and prove the significance of the tool.

[4a] Write down prolog program to find Goldbach's conjecture.

Goldbach's conjecture says that every positive even number greater than 2 is the sum of two prime numbers. Example: 28 = 5 + 23. It is one of the most famous facts in number theory that has not been proved to be correct in the general case. It has been *numerically* confirmed up to very large numbers (much larger than we can go with our Prolog system). Write a predicate to find the two prime numbers that sum up to a given even integer.

Example:
?- goldbach(28, L).
L = [5,23]

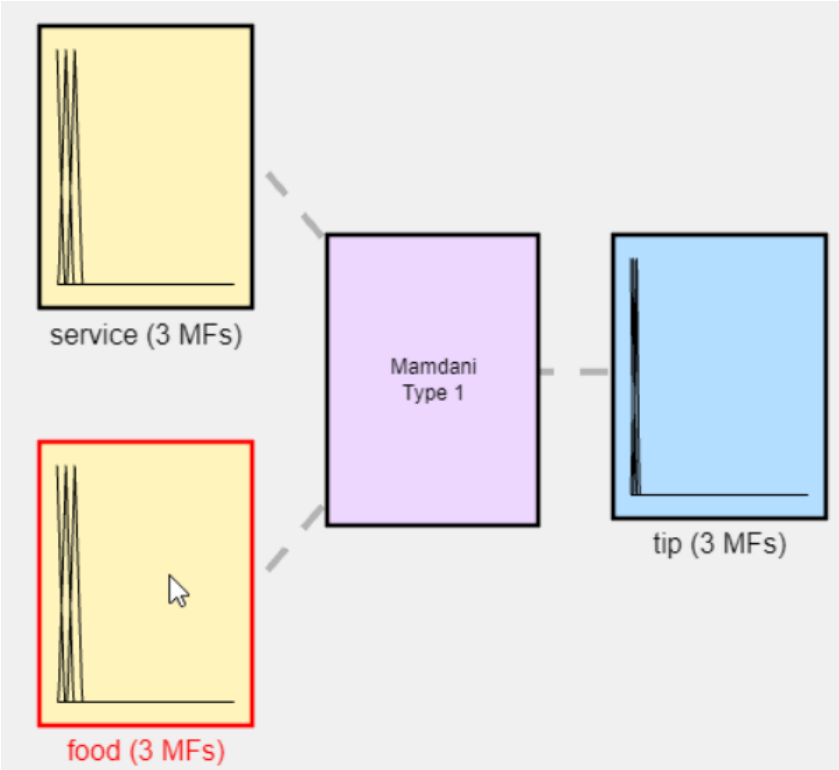
[4b] Design the following workflow in WEKA. Read the iris dataset and generate classification performance result:



[5a] Write a prolog program

- To find the Kth element of a List
- To reverse a list
- To eliminate consecutive duplicates of list elements.

[5b] Design a simple fuzzy control system to decide tip based on food quality and service received.


service (3 MFs)
food (3 MFs)
Mamdani
Type 1
tip (3 MFs)