IT402: SOFT COMPUTING
Mid Semester Exam 2021

Name: Chinmayi C Ramakrishna
Roll no: 18IIT113

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Hard computing	Soft Computing
It requires programs to be hard written.	It can be evolved into its own programs.
It uses two valued logic. It has features of exactness and categoricity.	It uses fuzzy logic. It has the features of approximation and dispositionality.
It is deterministic in nature	It is stochastic in nature
It works on clean and exact data.	It works on ambiguous, dirty and noisy data
It produces exact results.	It produces approximate results.
It produces settled code and results.	It incorperates randomness

Sequential computation	Can perform parallel computation.
Exactly stated analytical model.	Tolerant to imprecise, approximation-based and uncertain data.
eg:- Merge sort, Search algorithms	eg:- Fuzzy logic, neural network

Components of Soft computing

1. Probabilistic Logic :- It handles the uncertainty to use formal argument structure.
2. Machine Learning :- used to improve performance on a task by remodeling.
3. Evolutionary computation :- It is a subfield of artificial intelligence, used for global optimisation.
4. Fuzzy Logic :- handles partial truth that can range between 0 and 1.
5. Neural Networks :- a collection of neurons forming layers to solve a problem.
6. Support Vector Machine :- used for classification and regression

7. Hybrid techniques can be used to achieve better results in soft computing
8. Genetic Algorithm

Goals of Soft computing.

Main Goal :- develop intelligent machines to solve real world problems which are difficult to model mathematically.

Resemblance with human decision making.

Exploit the tolerance for uncertainity, imprecision, approximation and partial truth.

Rapid dissemination of important results through soft computing.

- Image processing and data compression.
- Data mining
- Power and control systems
- Handwriting recognition
- Clustering based on similarity
- Face recognition and speech recognition

2. $k = 5$

age <= 30, income = medium, student = yes, credit-rating = fair

ID	Similarity (A, B)
1	(1/4 + 0 + 0 + 1/4) = 1/2 = 0.5
2	1/4 + 0 + 0 + 0 = 1/4 = 0.25
3	0 + 0 + 0 + 1/4 = 1/4 = 0.25
4	0 + 2/4 + 0 + 1/4 = 3/4 = 0.75
5	0 + 0 + 1/4 + 1/4 = 2/4 = 0.5
6	0 + 0 + 1/4 + 0 = 1/4 = 0.25
7	0 + 0 + 1/4 + 0 = 1/4 = 0.25
8	1/4 + 2/4 + 0 + 1/4 = 4/4 = 1
9	1/4 + 0 + 1/4 + 1/4 = 3/4 = 0.75
10	0 + 2/4 + 1/4 + 1/4 = 1
11	1/4 + 2/4 + 1/4 + 0 = 1
12	0 + 2/4 + 0 + 0 = 0.5
13	0 + 0 + 1/4 + 1/4 = 0.5
14	0 + 2/4 + 0 + 0 = 0.5

Since $k = 5$

IDs considered: 4, 8, 9, 10, 11 (Yes, No, Yes, Yes, Yes)

majority of IDs have class label "Yes"

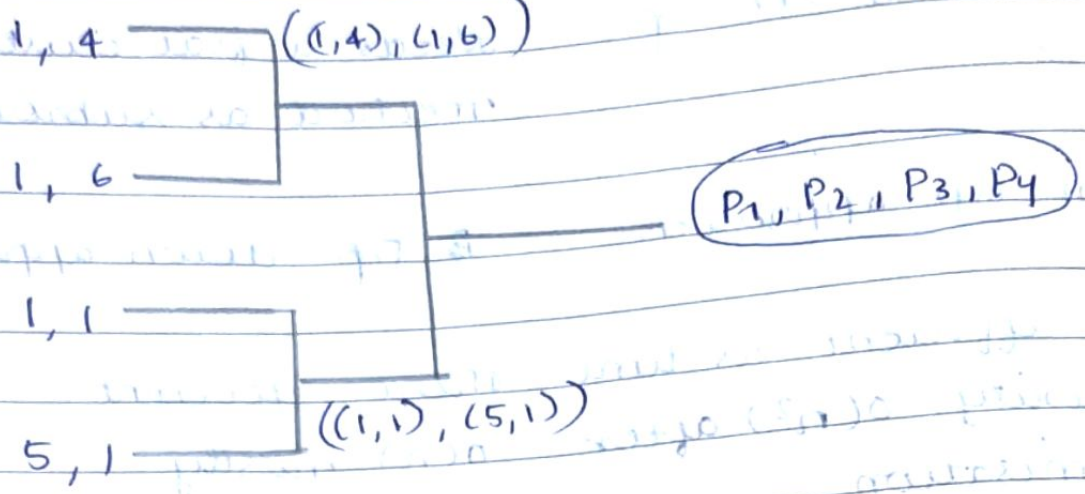
Hence, the new example with attributes age <= 30, income = medium, student = yes, credit-rating = fair is "Yes"

3.

Agglomerative	Divisive
More informative than unstructured set of clusters.	More complex Needs a flat clustering method as subroutine
Bottom-up approach	Top-down approach
Less efficient as time complexity $O(n^2)$ after optimisation	More efficient $O(n)$ mostly
Doesn't take into account global distribution of data.	More accurate. It takes global distribution of data
Starts with every data point as a cluster	Starts with all data points as one cluster

Agglomerative method

	1,1	1,4	1,6	5,1
(1,1)	0	3	5	4
(1,4)	3	0	2	3+4=7
(1,6)	5	2	0	9
(5,1)	4	7	9	0



4.

$$Info(D) = -\frac{5}{14}\log_2\left(\frac{5}{14}\right) - \frac{9}{14}\log_2\left(\frac{9}{14}\right)$$

$$= -0.159 - 0.123$$

$$= 0.2823$$

$$Info_{outlook}(D) = \frac{5}{14}$$