**Logic of Problem:**

**The problem you are analyzing:** Car Evaluation

**Statement of the problem:**

Using a private means for transportation is a norm in society today. And what better than a car could it be when it comes to one such means. Owning a car gives an individual a sense of status and the opportunity for being in personal control and autonomy. In thinly populated areas, owning a car is crucial, as it provides the only means for travelling long distances due to a lack of public transport. Even when public transport is available, people may express anxiety about the poor quality of public transport services. The lack of feasible transport alternatives to the private automobile make owning one undisputable. Keeping this in mind, it becomes even more important to evaluate a car which you want to own so that it’s a best fit in terms of price, maintenance, comfort, safety apart from fuel efficiency.

**The Purpose of reasoning through the issues is:**

The purpose of this study is to evaluate a car based on its overall price, comfort, number of persons it can accommodate, safety, comfort, size of luggage boot, maintenance cost, buying price and other technical characteristics so that we can ensure a customer that the car he is buying is worth the money invested by classifying the car’s status as being unacceptable, acceptable, good and very good.

**The key question at issue is:**

We would mainly like to base our thinking to target the issues like: How can we identify if a car is worth buying? Are we getting the best deal price wise? If we plan to exchange or trade the car, how can we get the best offer? How can we fix the price based on its brand, model and registration date? Since the condition of a car includes both the chassis as well as interior, its value can be also influenced by the condition of equipment (whether it is damaged or missing). It is also worth knowing which parts of equipment were changed and which might need replacement. Knowing the number of owner’s, in case of secondhand purchase also needs to be questioned as a car with only one owner could command a higher price. We can use the element of rationality when assessing the key question at issue. Rationality will help us to get sensible answers to the questions at issue.

**Information:**

In the present situation people cannot solely depend on public transportation means to travel. Having their own car has become a necessity. People have adapted new strategies to select cars by evaluating the car features. Generally, customer reviews play a key role to compare the

features. A study says 63% of people discovered cars online [2]. In the same way recommendation systems help to understand the better features as per the need. Technology plays an important role in the automobile industry. Especially abled people focus on the features which help them in safe driving. Price, safety and fuel efficiency being the prime attributes to evaluate the vehicle and then can classify into different categories [3]. People who are planning to purchase a car will gather information about reliability and cost efficiency of the car. So, reliability is an important standard.

**Interpretations and Inferences:**

At times new emerging technology being added in the automobile industry makes it difficult to classify the car features into appropriate categories. In order to make classification less intense, consider the prime attributes to compare. The customer satisfaction can be driven by user reviews and the number of cars sold. Low maintenance cars usually catch attraction. Safety being the prime factor for consideration. Therefore, it is important and useful to classify the cars into different categories like acceptable, unacceptable, good and very good based on these evaluation factors.

**Concepts:**

Cars aid people to move, travel and help in reaching the specified destination easily. People purchase the car by evaluating the features of the car meeting their needs. As technology is emerging in manufacturing cars with everyday adding new features to the cars. People tend to compare few basic attributes while evaluating and classifying them into different categories like acceptable, unacceptable, good and very good to purchase. Generally, the first attribute to focus on is the price of the car. Any individual will plan a car purchase as per their economic condition and affordance. Need to look after the other prices like maintenance price and car insurance prices. People consider the added technical features which includes safety features like airbags, blind spot indication and protection. Type of car is chosen depending on the seating capacity. Space available for the luggage boot. Depending on these conditions the attributes are considered in the dataset. The attributes like buying, maintenance, doors, persons, lug boot and safety are studied using the Weka tool. Out of the many supervised data mining algorithms available we plan to choose Classifier algorithms like Naïve Bayes Classifier, KNN classifier, Decision Trees and JRip in the weka tool to understand how the results vary when each of these are applied on the dataset. This will help us gain better understanding of the various classifier algorithms when we study the confusion matrix, accuracy and other statistics obtained after running the tests. We can use strategy as a standard which helps us to have a better understanding of the concept before purchasing a car.

**Assumptions:**

The basic assumption of car evaluation will be to make sure that the car will be reliable for a couple of years. The assumption will always depend on the requirement. For Instance, if the buyer is a student, then his/her assumption will be to buy a good-looking car, if the buyer is a travel enthusiast/aged person, then their assumption would be to buy a reliable car. The biggest assumption that a buyer thinks is that if the car looks good/new then they would be attracted rather than assessing the entire car. There are some assumptions which are quite difficult to evaluate such as engine health, minor/major repairs, whether involved in accidents and few others. Another assumption which should be seriously considered is the authenticity of the seller before evaluating the car. If these are the assumptions from the user’s perspective, some of the assumptions that can be made looking at our dataset are mainly based on 2 criteria namely, PRICE related and TECH related. This is because the attributes considered are distributed only under these 2 criteria. That is, buying and maintenance attributes fall under PRICE category and the others like doors, persons, lug\_boot and safety are under technical characteristics. This is clearly observed when we look at the Header information of the dataset. Hence, we can verify that our assumptions are in line with the data set assumptions.

**Implications:**

The fundamental implication would be whether the buyer can afford the car and is the evaluation appropriate concerning the requirement. This can become a concern if buying a new car as it will be expensive when compared to buying a used car. The major implication for buying a used car would be the maintenance whose implication would depend on whether it is maintained well or not. Whose further implication if not maintained well, would be to determine how much it would cost to repair it. Finally leading to an implication regarding whether it is worth buying that used car with repair cost included. Appropriate Insurance should be chosen so that in case of any mishaps, those expenses should be covered by the insurance and shouldn’t be a burden to the buyer later since no one would like to deal with these implications. Further, we will also be looking at the upside and downside of the car evaluation, when we implement the solutions using various algorithms.

**Point of View:**

The main reason to evaluate a car from a buyer’s point of view is to make sure that they aren’t deceived. Evaluating a car externally will never be a good idea since a car has several thousand parts, and each part can be crucial for its lifespan. There shouldn’t be any regret after buying the car. From a Seller’s point of view, the seller would always like to sell the car as high as possible, but the seller should make appropriate analysis before selling the car. As a team working on the car evaluation dataset, it is our point of view that only when we consider both buyer and seller perspectives overall, we can come to an impartial, unbiased decision regarding whether the car can be bought or not. Here since buyer and the seller are the only 2 stakeholders involved, we will keep in mind about best interests for both the parties involved when studying

the dataset and making decisions for evaluating a car such that it is a fair result to both the stakeholders involved. The buyer should think rationally about the car before purchasing it.

**Going through checkpoint 1 through 3 and studying the dataset we can summarize our experiences of applying Logic of problem as follows.**

We realized the importance of having private means of transportation in present situation , we made study plans to evaluate a car based on its characteristics.We mainly made our efforts to target the issues.Through this process of study, we analyzed and realized the importance of the element, rationality while assessing.In the information phase, while collecting data about considerations of people, we came across that people focus on reliability element along with cost efficiency.We can consider reliability as a standard element. During interpretation and inferences we focus on technology which we use to interpret the given data and support the conclusions drawn.While analyzing the concept behind evaluating a car based on its characteristics , we realized the importance of strategy as a standard to apply.While evaluating, we need to assume strategies based on requirements of every possible category of people.Further, we will also be looking at the upside and downside of the car evaluation, when we implement the solutions using various algorithms and we found that Random forest algorithm suits best. While considering the point of view of people ,we came across rationality as an important factor to evaluate. It helps buyers to think rationally about the car before purchasing. Thus these nine standard of elements have helped us to evaluate the problem of car evaluation in an efficient manner.

**Advantages of using this Analytical Thinking procedure**

* It assists in analyzing, collection of data thus improves researching skills .
* It helps to enhance problem solving ability.
* It helps to divide the problem into different steps and encourages analysis independently.
* It helps in pattern identification .
* It is useful in evaluating a particular object from available different options and thus encourages decision making.

**Disadvantages of using this Analytical Thinking procedure**

* Breaking down steps in procedure takes time hence slows down the process and sometimes it becomes quite expensive in terms of time.
* Analyzing results with similar values/precision may in turn affect decision making.
* Analyzing a large data set may produce overload , which inturn affects efficiency.
* Needs to have expertise in many fields in order to accomplish the task.
* It has led to concurrent critical thinking.

**Recommendations for addition of steps**

Apart from the existing standards used to create an LOP, we would recommend adding standards like Reliability, Strategy and Rationality to evaluate elements like information, concepts ,key question at issue and point of view in building the logic of the problem. Reliability evaluates information, Strategy evaluates concepts and Rationality evaluates key questions at issue and point of view. One can ensure that the problem being studied is reliable in terms of end results obtained, has a good strategy involved in the course of study to ensure accurate results and also rational to differentiate all the critical and non-critical aspects to be involved and excluded from the study. Thus, the LOP could be improved.