Q.1) Multivariate decision trees have practical advantages and disadvantages.

List the advantages and disadvantages you can think of when comparing multivariate decision trees to univariate decision trees.

A. Advantages and disadvantages of univariate decision trees over multivariate decision trees

1. A decision tree's branches are followed to conduct tests in a systematic manner. Consequently, only the features that are necessary to make a decision need to be assessed. It is preferable to test just the characteristics that are required given the supposition that there is some cost associated with acquiring the value of a feature.

2. The categorization of an instance may be determined sequentially using a decision tree, which offers a clear summary of the process. The most attractive thing is a small tree, the test is simple and clear because a person can grasp it. The decision to include multivariate testing comes with a trade-off: Using solely univariate tests may produce big, hard-to-understand trees, whereas adding multivariate tests may produce trees with fewer nodes but harder-to-understand test nodes.

B. Advantages and disadvantages of multivariate decision trees over univariate decision trees.

1. Decision trees are used often as base learners in ensemble classifiers or as standalone classifiers. This is mostly because decision trees have the benefit of being simple to explain. Users have employed MDTs, which permit combinations of characteristics when splitting a node, to enhance the classification performance of decision trees.

2. Axis-aligned splits result from univariate decision trees at each decision node that only takes into account the value of one feature. Each decision node in a multivariate decision tree uses an arbitrary hyperplane to split the input space in half, resulting in oblique splits. In this study, we describe and contrast the multivariate decision tree induction technique CART versus the univariate decision tree induction method ID3 using a series of simulations. We can see that multivariate trees are smaller and more accurate when feature selection comes first, but they also take longer to train.