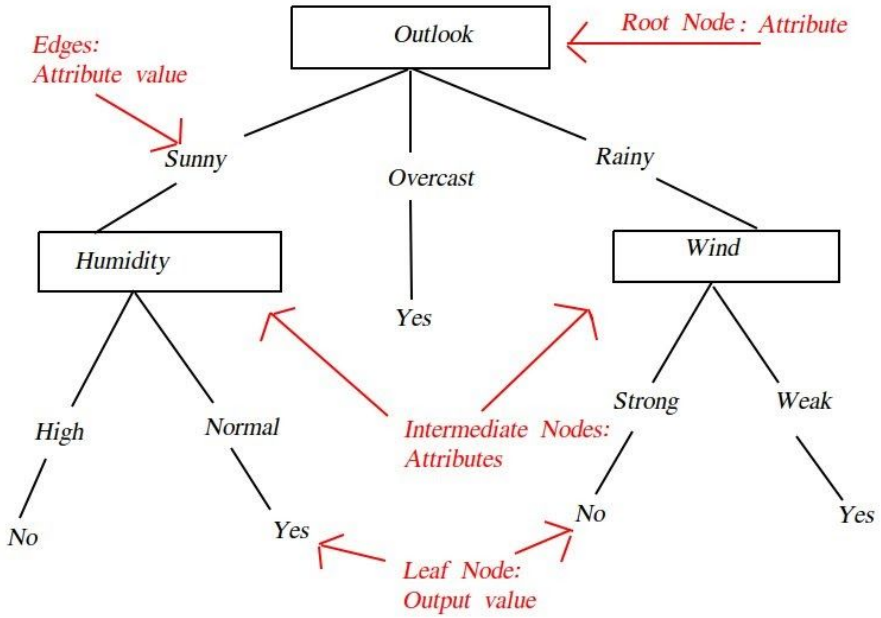
Assignment 4.2

Explain in your own words how a decision tree looks like, how a decision tree is used for classification, and how a decision tree is learned. Try to restrict to the most important points and be as clear as possible.

- Decision tree learning is a method for approximating *discrete-valued target functions*, in which the *learned function is represented by a decision tree*.
- Decision trees can also be represented by the *if-then-else* rule.
- Decision tree learning is one of the most widely used approaches for inductive inference.



Classification in Decision trees:

An instance is classified by starting at the root node of the tree, testing the attribute specified by this node, then moving down the tree branch corresponding to the value of the attribute in the given example. This process is then repeated for the subtree rooted at the new node.

- Decision trees represent a disjunction of the conjunction of constraints on the attribute values of instances.
- Each path from the tree root to a leaf corresponds to a disjunction of attribute test conditions and the tree itself to a disjunction of these conjunctions.

$$(Outlook = Sunny \wedge Humidity = Normal) \vee$$
$$(Outlook = Overcast) \vee$$
$$(Outlook = Rain \wedge Wind = Weak)$$

$$\textbf{IF}(Outlook = Sunny\ AND\ Humidity = Normal)\ \textbf{THEN}\ PlayTennis = Yes$$
$$\textbf{IF}(Outlook = Overcast)\ \textbf{THEN}\ PlayTennis = Yes$$
$$\textbf{IF}(Outlook = Rainy\ AND\ Wind = Weak)\ \textbf{THEN}\ PlayTennis = Yes$$

The basic decision tree learning algorithm used is the ***ID3 Algorithm.***