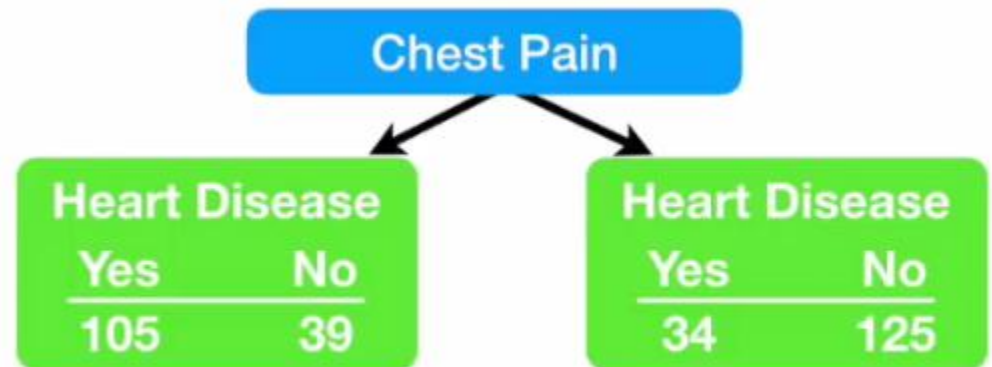
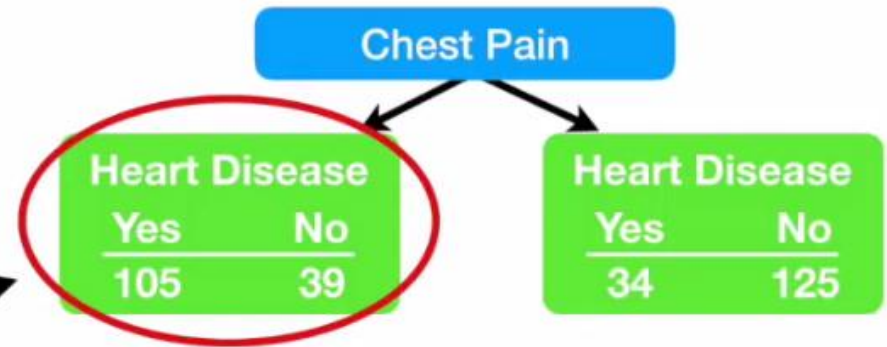


Let's start by calculating  
Gini impurity for Chest  
Pain...



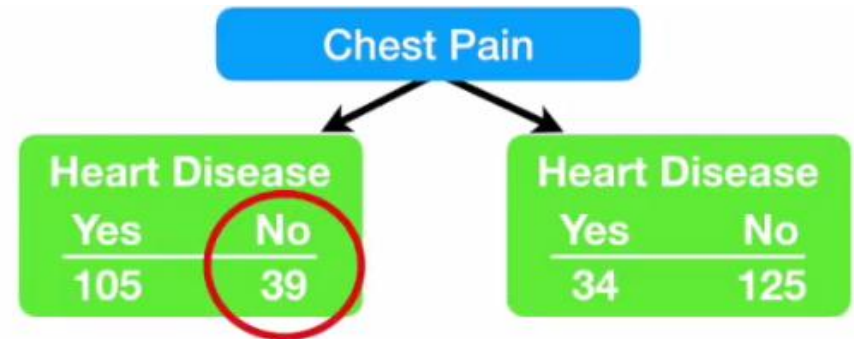


For this leaf, the Gini impurity =  $1 - (\text{the probability of "yes"})^2 - (\text{the probability of "no"})^2$



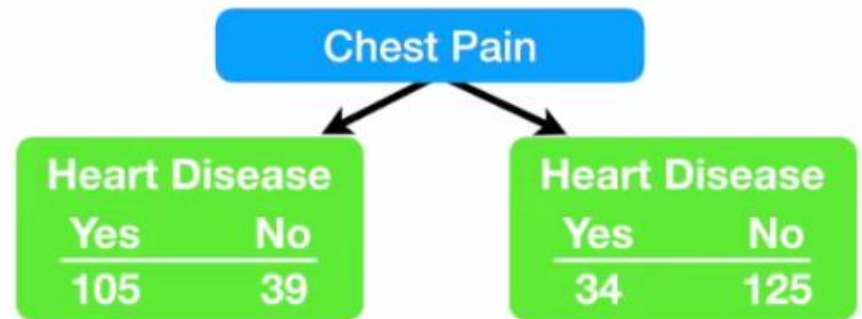
For this leaf, the Gini impurity =  $1 - (\text{the probability of "yes"})^2 - (\text{the probability of "no"})^2$

$$= 1 - \left( \frac{105}{105 + 39} \right)^2$$



For this leaf, the Gini impurity =  $1 - (\text{the probability of "yes"})^2 - (\text{the probability of "no"})^2$

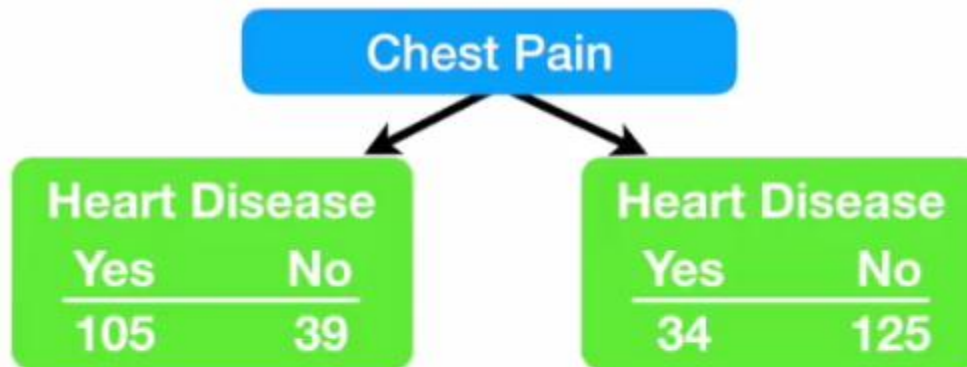
$$= 1 - \left( \frac{105}{105 + 39} \right)^2 - \left( \frac{39}{105 + 39} \right)^2$$



For this leaf, the Gini impurity =  $1 - (\text{the probability of "yes"})^2 - (\text{the probability of "no"})^2$

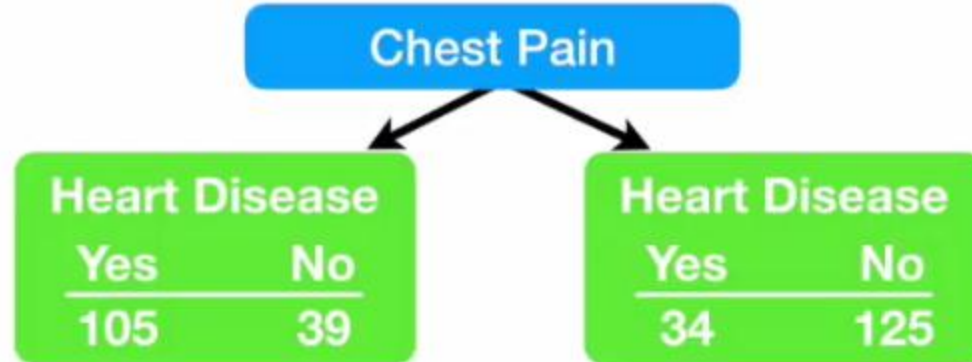
$$= 1 - \left(\frac{105}{105 + 39}\right)^2 - \left(\frac{39}{105 + 39}\right)^2$$

$$= 0.395$$



Gini impurity = 0.395

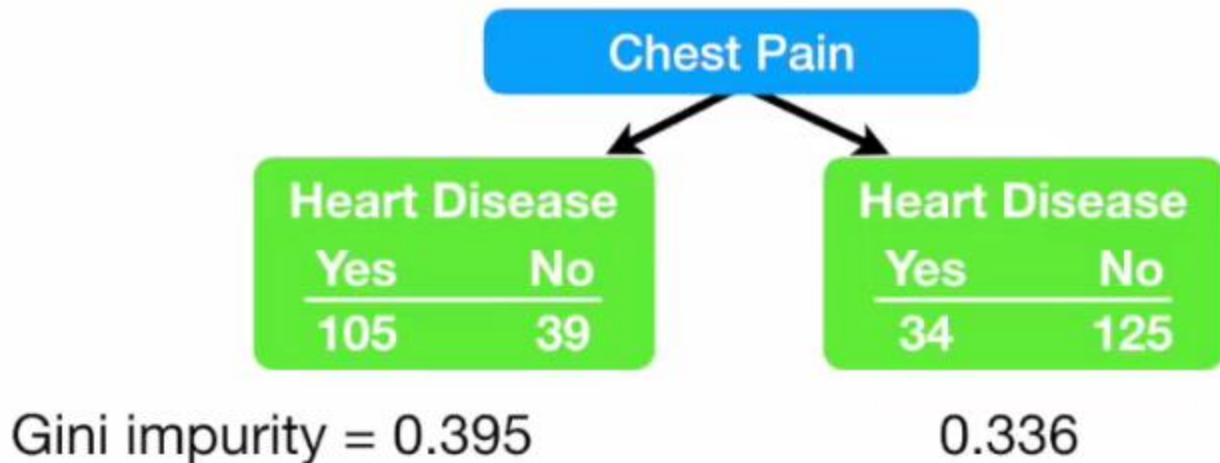
Now let's calculate the Gini impurity for this leaf node...



$$= 1 - (\text{the probability of "yes"})^2 - (\text{the probability of "no"})^2$$

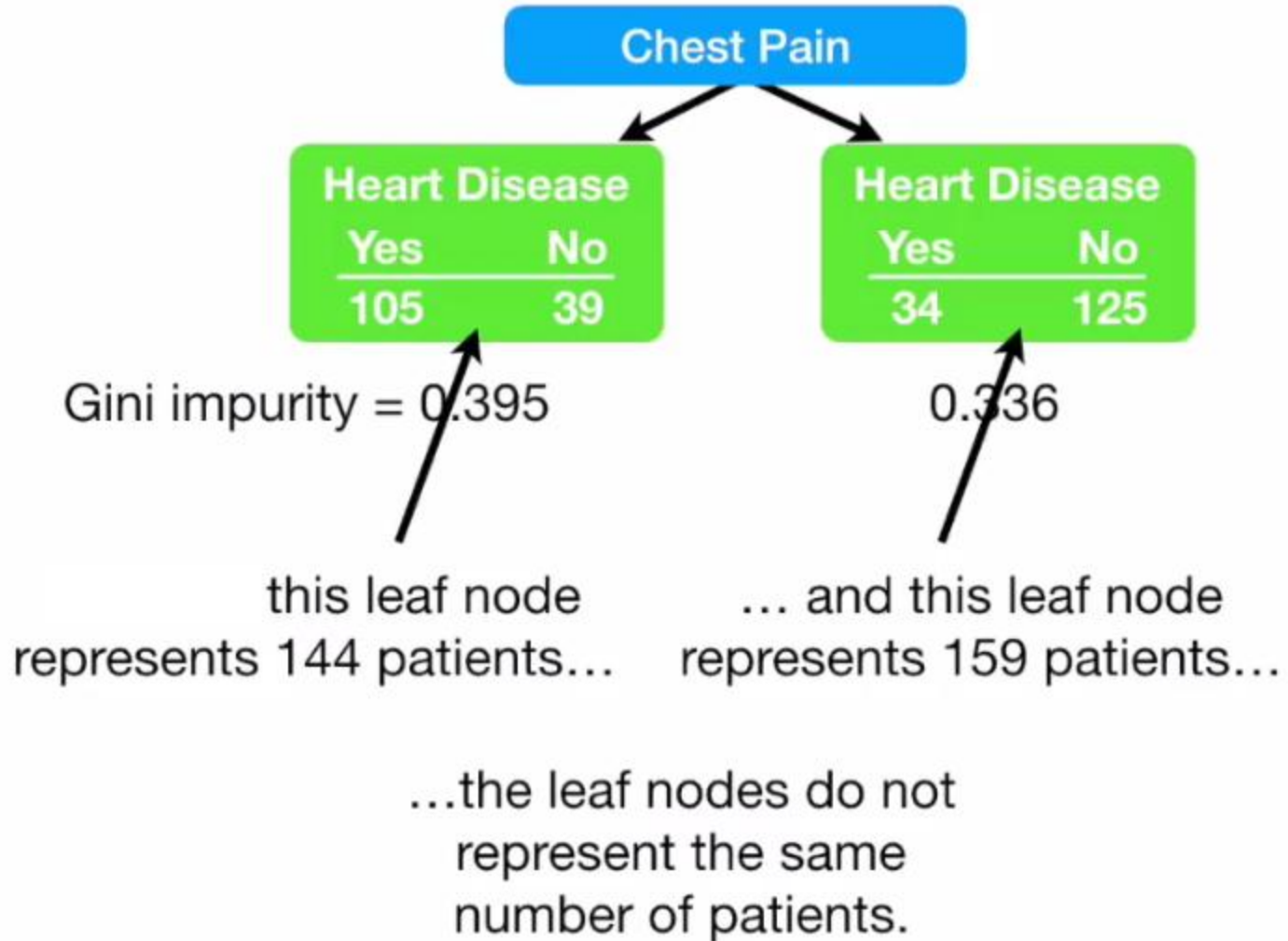
$$= 1 - \left( \frac{34}{34 + 125} \right)^2 - \left( \frac{125}{34 + 125} \right)^2$$

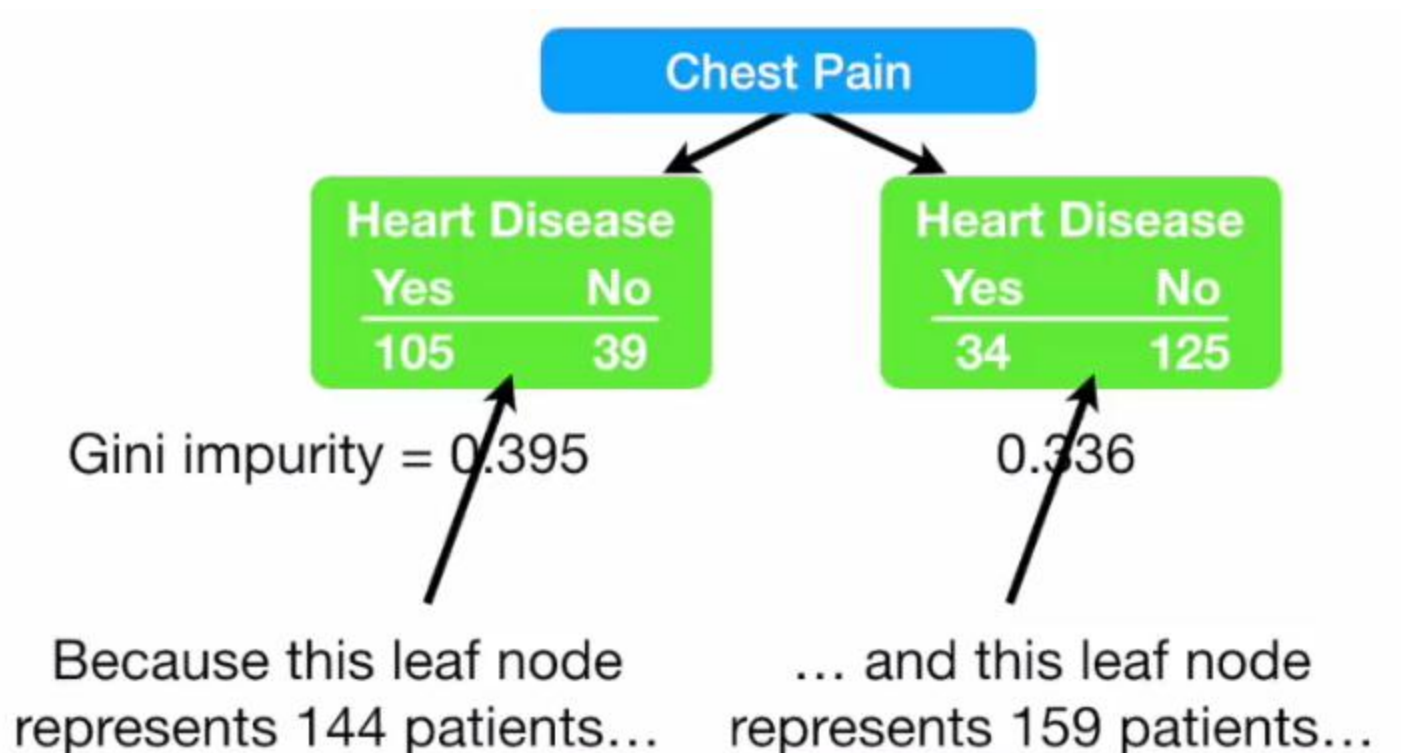
$$= 0.336$$



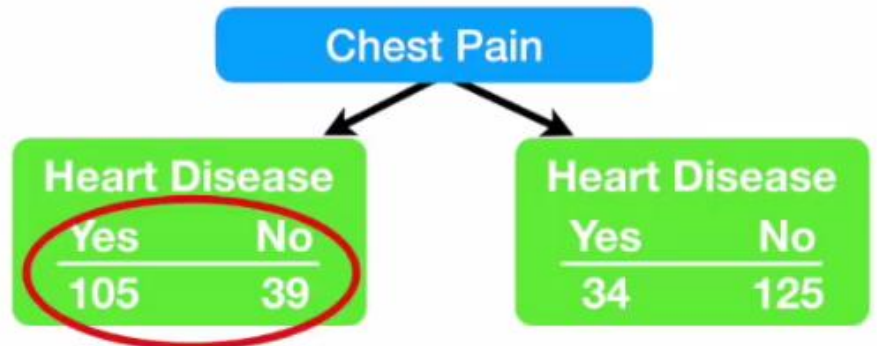
Now that we have measured the Gini impurity for both leaf nodes, we can calculate the total Gini impurity for using Chest Pain to separate patients with and without heart disease.







Thus, the total Gini impurity for using Chest Pain to separate patients with and without heart disease is the **weighted average of the leaf node impurities**.

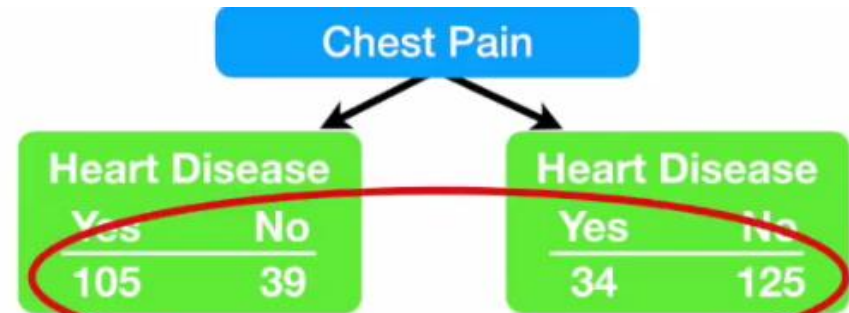


Gini impurity = 0.395

0.336

Gini impurity for Chest Pain = weighted average of Gini impurities for the leaf nodes

$$= \left( \frac{144}{144 + 159} \right) 0.395$$

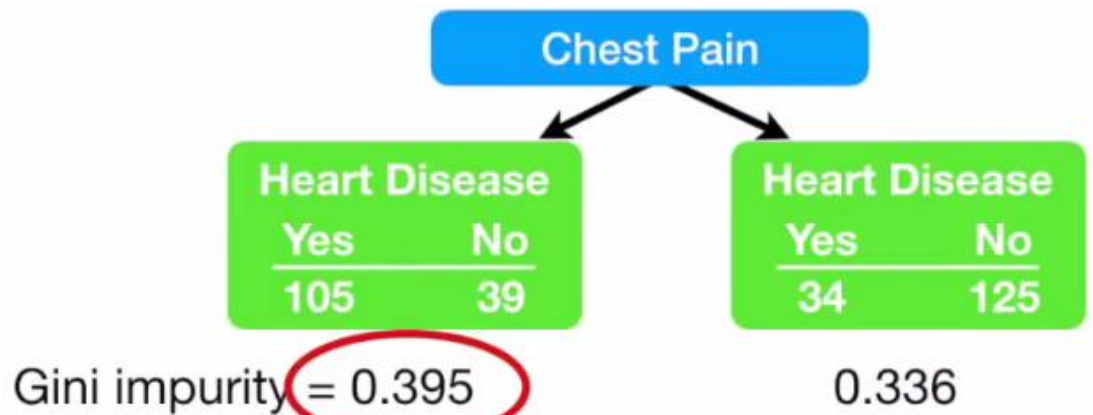


Gini impurity = 0.395

0.336

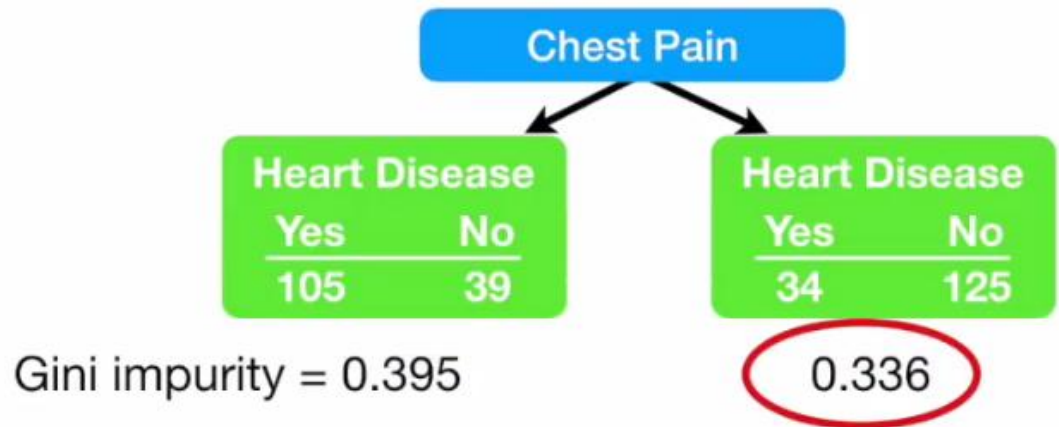
Gini impurity for Chest Pain = weighted average of Gini impurities for the leaf nodes

$$= \left( \frac{144}{144 + 159} \right) 0.395$$



Gini impurity for Chest Pain = weighted average of Gini impurities for the leaf nodes

$$= \left( \frac{144}{144 + 159} \right) 0.395$$



Gini impurity for Chest Pain = weighted average of Gini impurities for the leaf nodes

$$= \left( \frac{144}{144 + 159} \right) 0.395 + \left( \frac{159}{144 + 159} \right) 0.336$$

$$= 0.364$$