Type of family	Age group	Income Status	Will they buy a car
Nuclear	Young	Low	Yes
Extended	old	Medium	No
Childless	Middle-aged	Low	No
Child less	Young	Medium	Yes
Single Parent	Young	Medium	Yes
Childless	Young	Low	No
Nuclear	old	High	Yes
Nuclear	Middle-aged	Medium	Yes
Extended	Middle-aged	High	Yes
Single Parent	old	Low	No

Gini Impurity for 'Type of family' feature :

G_1 (class = 'Nuclear') $\Rightarrow 1 - \left[(P(yes))^2 + (P(No))^2 \right]$

$\Rightarrow 1 - \left[(3/3)^2 + 0 \right]$

$\Rightarrow 0$

G_1 (class = 'Childless' / Extend) $\Rightarrow 1 - \left[(P(yes))^2 + (P(No))^2 \right]$

$\Rightarrow 1 - \left[(1/2)^2 + (1/2)^2 \right]$

$\Rightarrow 1 - \left[1/4 + 1/4 \right] \Rightarrow 1 - 1/2$

$\Rightarrow 1/2$

$G_1(\text{class} = \text{'childless'}) \Rightarrow 1 - [(P(\text{yes}))^2 + (P(\text{NO}))^2]$

$\Rightarrow 1 - [(1/3)^2 + (2/3)^2]$

$\Rightarrow 1 - [1/9 + 4/9] \Rightarrow 1 - [5/9]$

$\Rightarrow 4/9$

$G_1(\text{class} = \text{'single Parent'}) \Rightarrow 1 - [(P(\text{yes}))^2 + (P(\text{NO}))^2]$

$\Rightarrow 1 - [(1/2)^2 + (1/2)^2]$

$\Rightarrow 1 - [1/4 + 1/4]$

$\Rightarrow 1 - (1/2) \Rightarrow 0.5$

Gini Impurity for the feature 'Age Group'

$G_1(\text{class} = \text{'Young'}) \Rightarrow 1 - [(P(\text{yes}))^2 + (P(\text{NO}))^2]$

$\Rightarrow 1 - [(3/4)^2 + (1/4)^2]$

$\Rightarrow 1 - [9/16 + 1/16] \Rightarrow 1 - 10/16 \Rightarrow 4/9 \Rightarrow 3/8$

$G_1(\text{class} = \text{'Old'}) \Rightarrow 1 - [(1/3)^2 + (2/3)^2]$

$\Rightarrow 4/9$

$G_1(\text{class} = \text{'Middle-aged'}) \Rightarrow 1 - [(2/3)^2 + (1/3)^2] \Rightarrow 1 - [4/9 + 1/9]$

$\Rightarrow 4/9$

Weighted sum of Gini Impurity for the feature 'Type of family'

$\Rightarrow \left(\frac{3}{10} * 0\right) + \left(\frac{2}{10} * \frac{1}{2}\right) + \left(\frac{5}{10} * \frac{4}{9}\right) + \left(\frac{2}{10} * \frac{1}{2}\right)$

$\Rightarrow 0 + \frac{1}{10} + \frac{2}{15} + \frac{1}{10}$

$\Rightarrow \frac{2}{10} + \frac{2}{15} \Rightarrow \frac{1}{3} \Rightarrow 0.33$

Weighted sum of Gini Impurity for the feature 'Age Group'

$\Rightarrow \left(\frac{4}{10} * \frac{3}{8}\right) + \left(\frac{5}{10} * \frac{4}{9}\right) + \left(\frac{5}{10} * \frac{4}{9}\right)$

$\Rightarrow \frac{3}{20} + \frac{2}{15} + \frac{2}{15} \Rightarrow \frac{3}{20} + \frac{4}{15} \Rightarrow \frac{5}{12} \Rightarrow 0.41667$

Gini Impurity for the feature 'Income Status'

$G_I(\text{class} = \text{'Low'}) \Rightarrow 1 - \left[(P(\text{yes}))^2 + (P(\text{NO}))^2 \right]$

$\Rightarrow 1 - \left[(1/4)^2 + (3/4)^2 \right]$

$\Rightarrow 3/8$

$G_I(\text{class} = \text{'Medium'}) \Rightarrow 1 - \left[(P(\text{yes}))^2 + (P(\text{NO}))^2 \right]$

$\Rightarrow 1 - \left[(3/4)^2 + (1/4)^2 \right]$

$\Rightarrow 3/8$

$G_I(\text{class} = \text{'High'}) \Rightarrow 1 - \left[(P(\text{yes}))^2 + (P(\text{NO}))^2 \right]$

$\Rightarrow 1 - \left[(2/2)^2 + (0)^2 \right]$

$\Rightarrow 0$

Weighted sum of Gini Impurity for the feature 'Income Status'

$\Rightarrow 4/10 * 3/8 + 4/10 * 3/8 + 2/10 * 0$

$\Rightarrow 3/20 + 3/20 \Rightarrow 6/20 \Rightarrow 0.30$

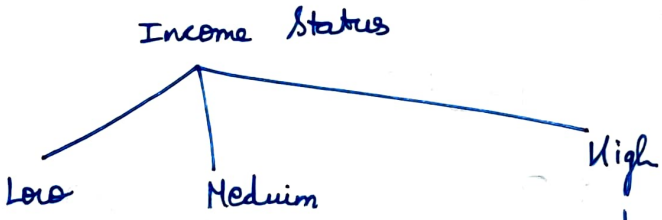
Weighted sum of Gini Impurity

Type of Family $\Rightarrow 0.33$

Age Group $\Rightarrow 0.41667$

Income Status $\Rightarrow 0.30$

Splitting on the root Node } 'Income Status' [Lowest ~~Highest~~ Weighted gini impurity]



Yes

[Requires No further splitting]

Low Income status

Type of family	Age Group	Will they buy a Car
Nuclear	Young	Yes
Child-less	Middle-aged	NO
Child-less	Young	NO
Single Parent	old	NO

Medium income status

Type of family	Age Group	Will they buy a Car
Extended	old	NO
Child-less	Young	Yes
Single-parent	Young	Yes
Nuclear	Middle-aged	Yes

Low income status

Gini Impurity for 'Type of family'

$G_I(\text{class} = \text{'Nuclear'}) \Rightarrow 1 - [(P(yes))^2 + (P(NO))^2]$

$\Rightarrow 1 - [1+0]$

$\Rightarrow 0$

$G_I(\text{class} = \text{'child-less'}) \Rightarrow 1 - [(P(yes))^2 + (P(NO))^2]$

$\Rightarrow 1 - [0 + 2/2]$

$\Rightarrow 0$

$G_I(\text{class} = \text{'single Parent'}) \Rightarrow 1 - [(P(yes))^2 + (P(NO))^2]$

$\Rightarrow 1 - [0+1]$

$\Rightarrow 0$

Weighted sum of gini impurity for "Type of family"

$\Rightarrow (1/4 * 0) + (3/4 * 0) + (1/4 * 0)$

$\Rightarrow 0$

Gini Impurity for 'Age Group' feature

$G_I(\text{class} = \text{'Young'}) \Rightarrow 1 - [(1/2)^2 + (1/2)^2]$

$\Rightarrow 1/2$

$G_I(\text{class} = \text{'Old'}) \Rightarrow 1 - [0+1]$

$\Rightarrow 0$

$G_I(\text{class} = \text{'medium aged group'}) \Rightarrow 1 - [1+0]$

$\Rightarrow 0$

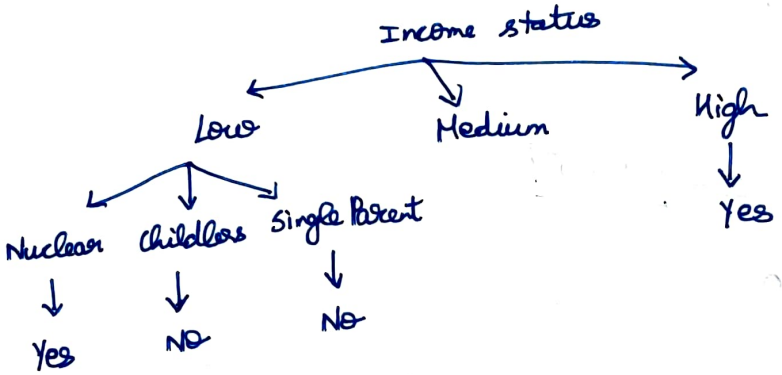
Weighted sum of Gini impurity for 'Age Group' feature

$\Rightarrow \left(\frac{2}{4} * \frac{1}{2}\right) + \left(\frac{1}{4} * 0\right) + \left(\frac{1}{4} * 0\right)$

$\Rightarrow \frac{1}{2}$

Weighted Sum of Gini Impurity
- Type of family $\Rightarrow 0$
- Age group $\Rightarrow \frac{1}{2}$

So splitting on Type of family



Medium income status

Gini Impurity for 'Type of family'

$G_I(\text{class} = \text{'Extended'}) \Rightarrow 1 - \left[(P(\text{yes}))^2 + (P(\text{NO}))^2\right]$

$\Rightarrow 1 - [0 + 1] \Rightarrow 0$

$G_I(\text{class} = \text{'Child-less'}) \Rightarrow 1 - \left[\left(\frac{1}{1}\right)^2 + 0^2\right] \Rightarrow 0$

$G_I(\text{class} = \text{'single-parent'}) \Rightarrow 1 - [0+1] \Rightarrow 0$

$G_I(\text{class} = \text{'Nuclear'}) \Rightarrow 1 - [1+0] \Rightarrow 0$

Weighted sum of Gini Impurity for 'Type of family'

$\Rightarrow \left(\frac{1}{4} * 0\right) + \left(\frac{1}{4} * 0\right) + \left(\frac{1}{4} * 0\right) + \left(\frac{1}{4} * 0\right)$

$\Rightarrow 0$

Gini impurity for 'Age Group' feature:

$G_I(\text{class} = \text{'Old'}) \Rightarrow 1 - [(P(yes))^2 + (P(NO))^2]$

$\Rightarrow 1 - [0 + 1]$

$\Rightarrow 0$

$G_I(\text{class} = \text{'Young'}) \Rightarrow 1 - [(P(yes))^2 + (P(NO))^2]$

$\Rightarrow 1 - [(1/2)^2 + (1/2)^2]$

$\Rightarrow 1/2$

$G_I(\text{class} = \text{'Middle Aged'}) \Rightarrow 1 - [1^2 + 0^2]$

$\Rightarrow 0$

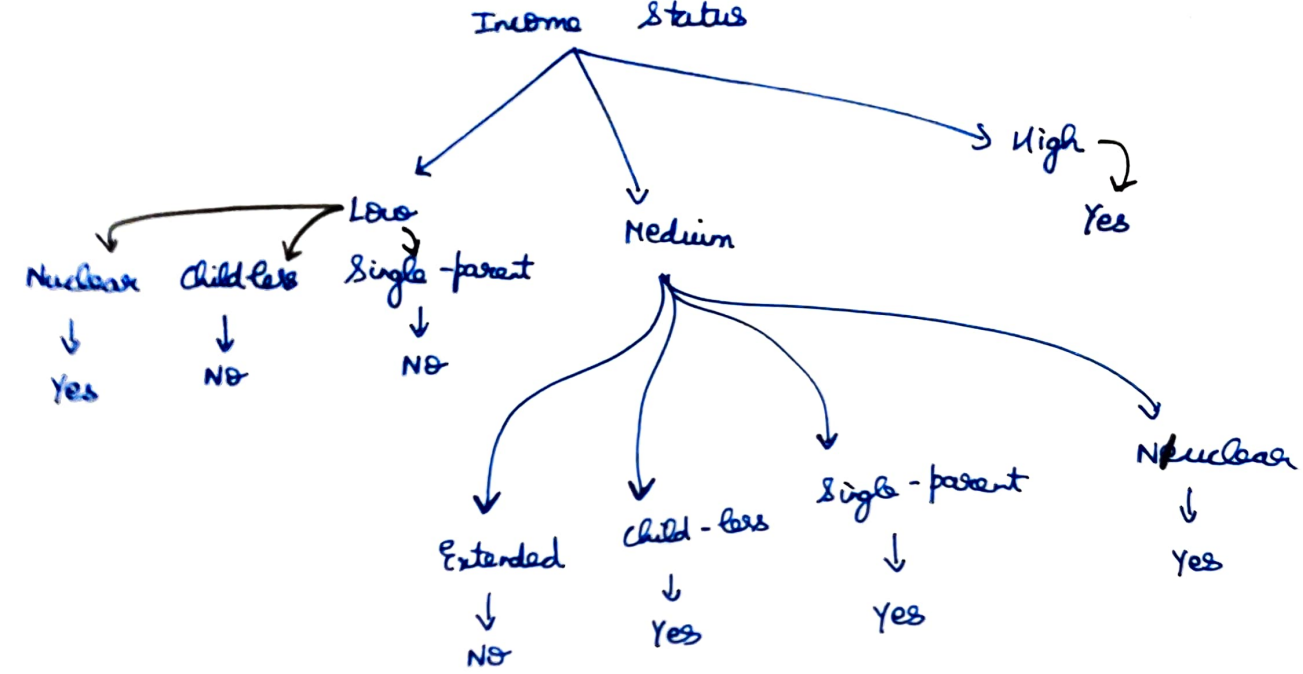
Weighted sum of Gini impurity for 'Age-Group' feature:

$\Rightarrow (1/4 * 0) + (2/4 * 1/2) + (1/4 * 0) \Rightarrow 1/4$

Weighted sum of Gini Impurity for 'Age-group' feature

- 'Type of family' $\Rightarrow 0$
- 'Age Group' $\Rightarrow 1/4$

so splitting of 'Type of family' feature.


Income Status
High
Yes
Low
Medium
Nuclear
Yes
Childless
NO
Single-parent
NO
Extended
NO
Child-less
Yes
Single-parent
Yes
Nuclear
Yes