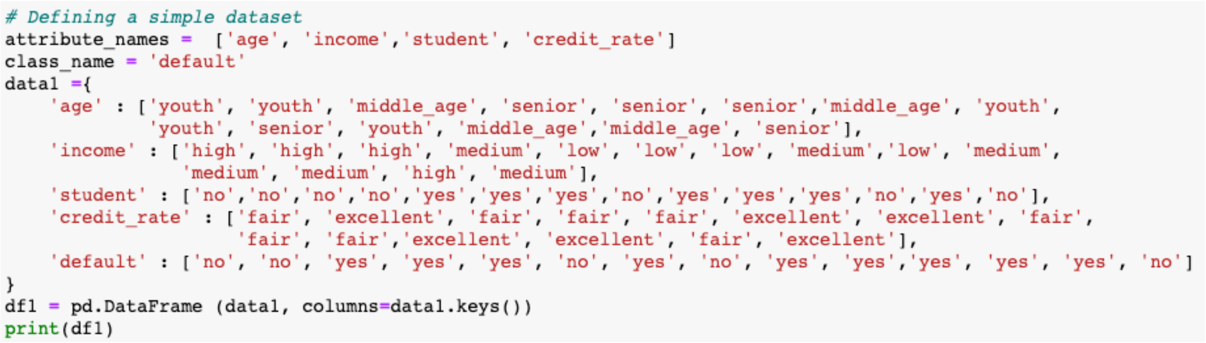
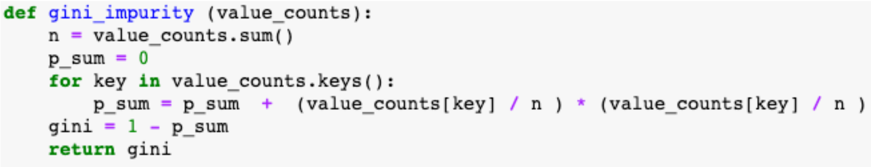
Ensemble methods – Gini impurity index

1. Defining.a data set



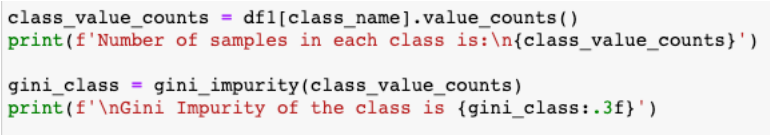
```
# Defining a simple dataset
attribute_names =  ['age', 'income','student', 'credit_rate']
class_name = 'default'
data1 ={
    'age' : ['youth', 'youth', 'middle_age', 'senior', 'senior', 'senior','middle_age', 'youth',
             'youth', 'senior', 'youth', 'middle_age','middle_age', 'senior'],
    'income' : ['high', 'high', 'high', 'medium', 'low', 'low', 'low', 'medium','low', 'medium',
                'medium', 'medium', 'high', 'medium'],
    'student' : ['no','no','no','no','yes','yes','yes','no','yes','yes','yes','no','yes','no'],
    'credit_rate' : ['fair', 'excellent', 'fair', 'fair', 'fair', 'excellent', 'excellent', 'fair',
                     'fair', 'fair','excellent', 'excellent', 'fair', 'excellent'],
    'default' : ['no', 'no', 'yes', 'yes', 'yes', 'no', 'yes', 'no', 'yes', 'yes','yes', 'yes', 'yes', 'no']
}
df1 = pd.DataFrame (data1, columns=data1.keys())
print(df1)
```

2. Function to calculate gini index



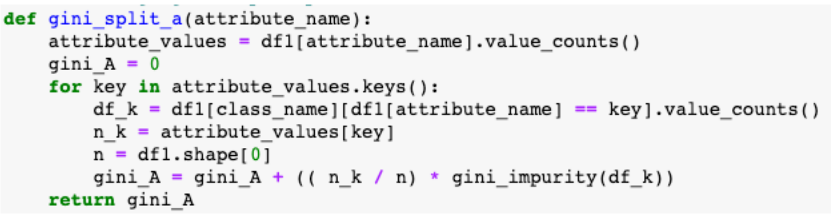
```
def gini_impurity (value_counts):
    n = value_counts.sum()
    p_sum = 0
    for key in value_counts.keys():
        p_sum = p_sum  +  (value_counts[key] / n ) * (value_counts[key] / n )
    gini = 1 - p_sum
    return gini
```

3. Calculate gini index on the targe variable



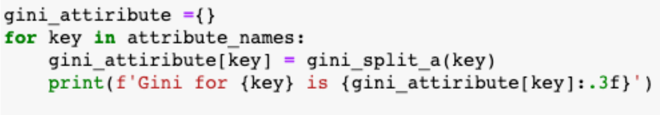
```
class_value_counts = df1[class_name].value_counts()
print(f'Number of samples in each class is:\n{class_value_counts}')

gini_class = gini_impurity(class_value_counts)
print(f'\nGini Impurity of the class is {gini_class:.3f}')
```

4. Function to calculate gini index on the attributes



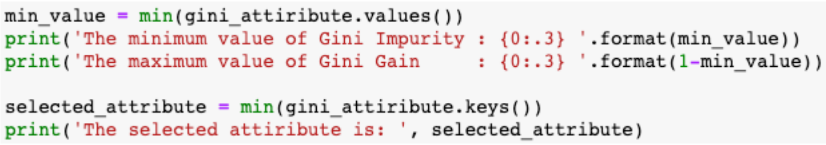
```
def gini_split_a(attribute_name):
    attribute_values = df1[attribute_name].value_counts()
    gini_A = 0
    for key in attribute_values.keys():
        df_k = df1[class_name][df1[attribute_name] == key].value_counts()
        n_k = attribute_values[key]
        n = df1.shape[0]
        gini_A = gini_A + (( n_k / n) * gini_impurity(df_k))
    return gini_A
```

5. Calculate gini index for all attributes



```
gini_attiribute ={}
for key in attribute_names:
    gini_attiribute[key] = gini_split_a(key)
    print(f'Gini for {key} is {gini_attiribute[key]:.3f}')
```

6. Compute Gini gain values to find the best split. The attribute with the maximum Gini gain is selected for splitting.



```
min_value = min(gini_attiribute.values())
print('The minimum value of Gini Impurity : {0:.3} '.format(min_value))
print('The maximum value of Gini Gain     : {0:.3} '.format(1-min_value))

selected_attribute = min(gini_attiribute.keys())
print('The selected attiribute is: ', selected_attribute)
```