```
import numpy as np
import pandas as pd
import seaborn as sns
import sklearn
import matplotlib.pyplot as plt
%matplotlib inline
```

```
from sklearn.datasets import fetch_openml

car_data = fetch_openml(name='car', version=2, parser='auto')
```

```
type(car_data)
```

```
sklearn.utils._bunch.Bunch
def __init__(**kwargs)

/usr/local/lib/python3.10/dist-packages/sklearn/utils/_bunch.py
Container object exposing keys as attributes.

Bunch objects are sometimes used as an output for functions and methods.
They extend dictionaries by enabling values to be accessed by key,
`bunch["value_key"]`, or by an attribute, `bunch.value_key`.
```

```
car_data.details
```

```
{'id': '991',
 'name': 'car',
 'version': '2',
 'description_version': '1',
 'format': 'ARFF',
 'upload_date': '2014-10-04T22:44:31',
 'licence': 'Public',
 'url': 'https://api.openml.org/data/v1/download/53525/car.arff',
 'parquet_url': 'https://openml1.win.tue.nl/datasets/0000/0991/dataset_991.pq',
 'file_id': '53525',
 'default_target_attribute': 'binaryClass',
 'tag': ['Chemistry',
  'derived',
  'Life Science',
  'mythbusting_1',
  'study_1',
  'study_15',
  'study_20',
  'study_41',
  'study_7'],
 'visibility': 'public',
 'minio_url': 'https://openml1.win.tue.nl/datasets/0000/0991/dataset_991.pq',
 'status': 'active',
 'processing_date': '2020-11-20 20:17:54',
 'md5_checksum': '49c57b793eef1b8e55f297e5e019fdbf'}
```

```
car_data.details['version']
```

```
'2'
```

```
# Data description
```

```
print(car_data.DESCR)
```

```
**Author**:
**Source**: Unknown - Date unknown
**Please cite**:

Binarized version of the original data set (see version 1). The multi-class target feature is converted to a two-class nominal targ

Downloaded from openml.org.
```

```
# Displaying feature names
```

```
car_data.feature_names
```

```
['buying', 'maint', 'doors', 'persons', 'lug_boot', 'safety']
```

```
# Getting the whole dataframe
```

```
car_data = car_data.frame
car_data.head()
```

	buying	maint	doors	persons	lug_boot	safety	binaryClass
0	vhigh	vhigh	2	2	small	low	P
1	vhigh	vhigh	2	2	small	med	P
2	vhigh	vhigh	2	2	small	high	P
3	vhigh	vhigh	2	2	med	low	P
4	vhigh	vhigh	2	2	med	med	P

Next steps: Generate code with car_data View recommended plots

```
type(car_data)
```

```
pandas.core.frame.DataFrame
def __init__(data=None, index: Axes | None=None, columns: Axes | None=None,
dtype: Dtype | None=None, copy: bool | None=None) -> None
/usr/local/lib/python3.10/dist-packages/pandas/core/frame.py
Two-dimensional, size-mutable, potentially heterogeneous tabular data.

Data structure also contains labeled axes (rows and columns).
Arithmetic operations align on both row and column labels. Can be
```

```
from sklearn.model_selection import train_test_split

train_data, test_data = train_test_split(car_data, test_size=0.3,
                                         random_state=20)

print('The size of training data is: {}\nThe size of testing data is: {}'.format(len(train_data),
                                       len(test_data)))
```

```
The size of training data is: 1209
The size of testing data is: 519
```

```
# Checking summary statistics

train_data.describe()
```

	buying	maint	doors	persons	lug_boot	safety	binaryClass
count	1209	1209	1209	1209	1209	1209	1209
unique	4	4	4	3	3	3	2
top	med	high	5more	more	big	med	P
freq	327	311	319	418	411	406	849

```
# Checking missing values
train_data.isnull().sum()
```

```
buying         0
maint          0
doors          0
persons        0
lug_boot       0
safety         0
binaryClass    0
dtype: int64
```

```
train_data['buying'].value_counts()
```

```
med      327
high     307
vhigh    291
low      284
Name: buying, dtype: int64
```

```
train_data['maint'].value_counts()
```

```
high     311
med      311
vhigh    294
low      293
Name: maint, dtype: int64
```

```
train_data['doors'].value_counts()
```

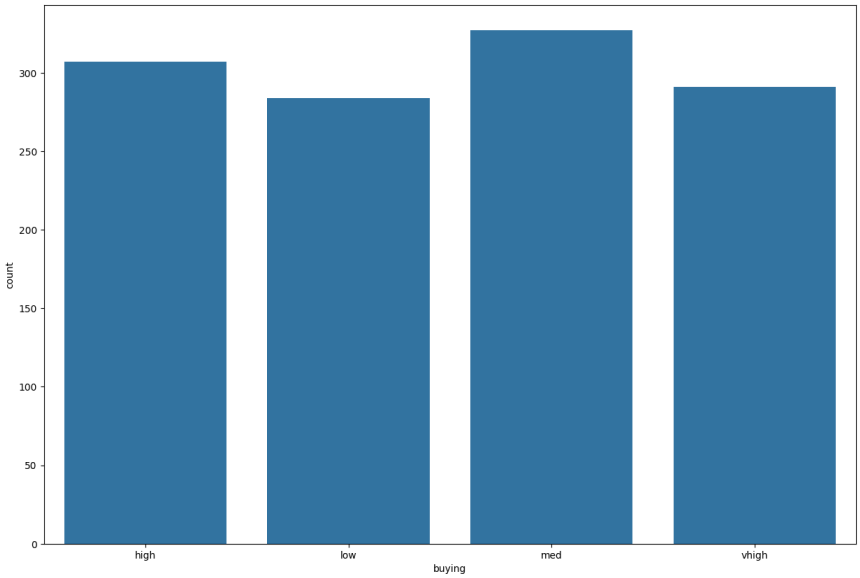
```
5more    319
2        312
4        296
3        282
Name: doors, dtype: int64
```

```
train_data['persons'].value_counts()
```

```
more    418
2       407
4       384
Name: persons, dtype: int64
```

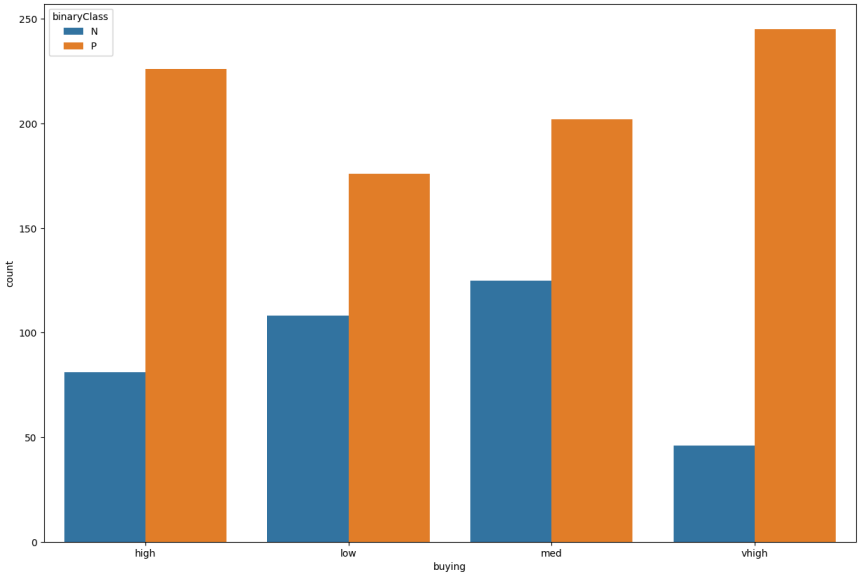
```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='buying')
```

```
<Axes: xlabel='buying', ylabel='count'>
```




```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='buying', hue='binaryClass')
```

```
<Axes: xlabel='buying', ylabel='count'>
```

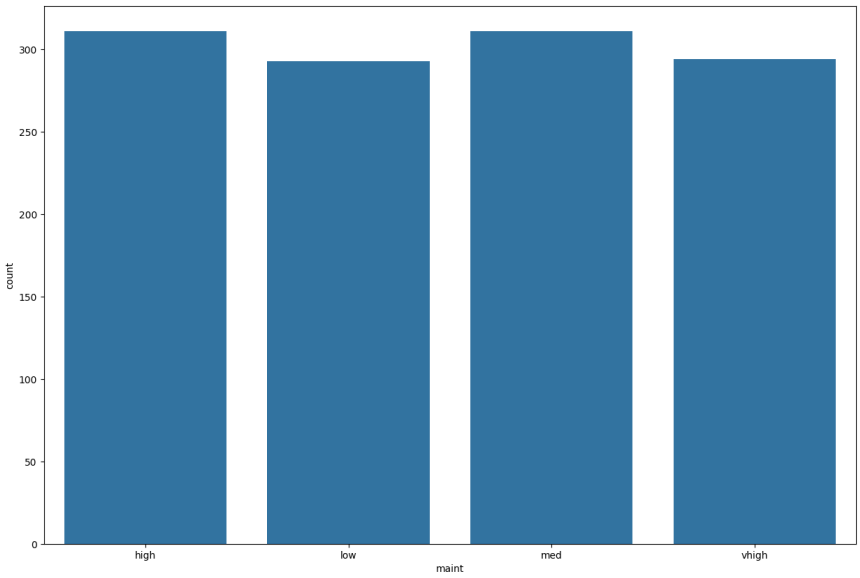



```
train_data['maint'].value_counts()
```

```
high     311
med      311
vhigh    294
low      293
Name: maint, dtype: int64
```

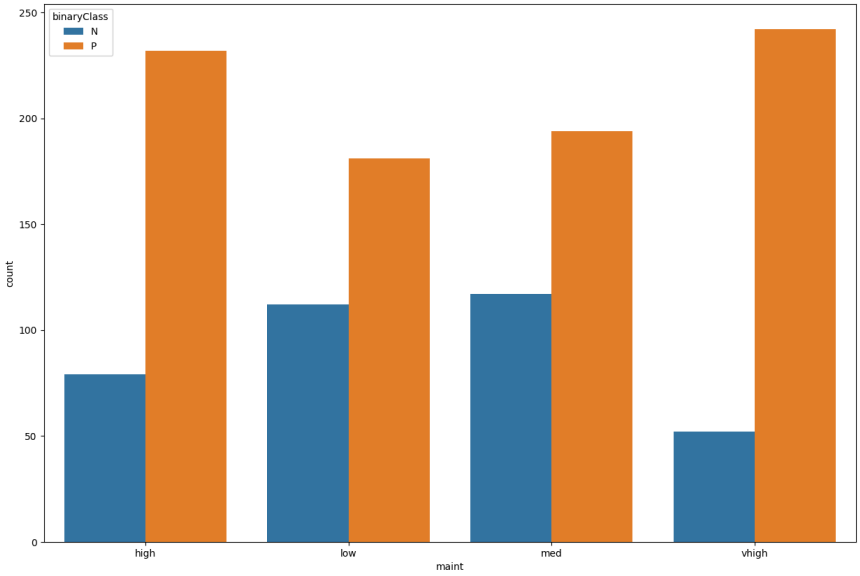
```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='maint')
```

```
<Axes: xlabel='maint', ylabel='count'>
```




```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='maint', hue='binaryClass')
```

```
<Axes: xlabel='maint', ylabel='count'>
```

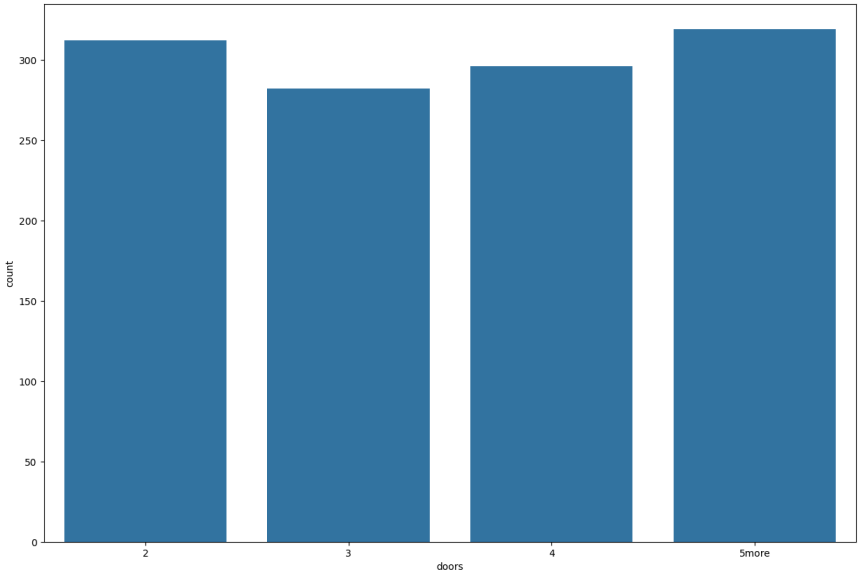



```
train_data['doors'].value_counts()
```

```
5more    319
2        312
4        296
3        282
Name: doors, dtype: int64
```

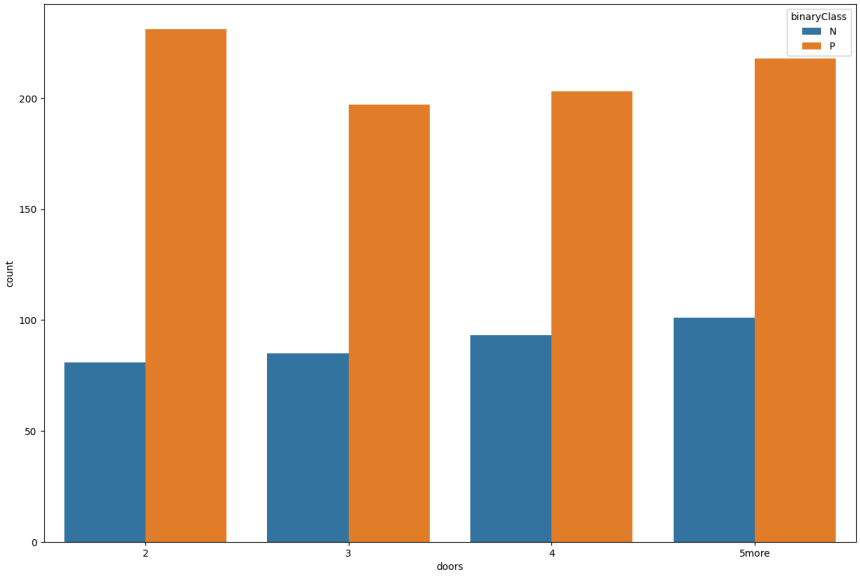
```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='doors')
```

```
<Axes: xlabel='doors', ylabel='count'>
```




```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='doors', hue='binaryClass')
```

```
<Axes: xlabel='doors', ylabel='count'>
```

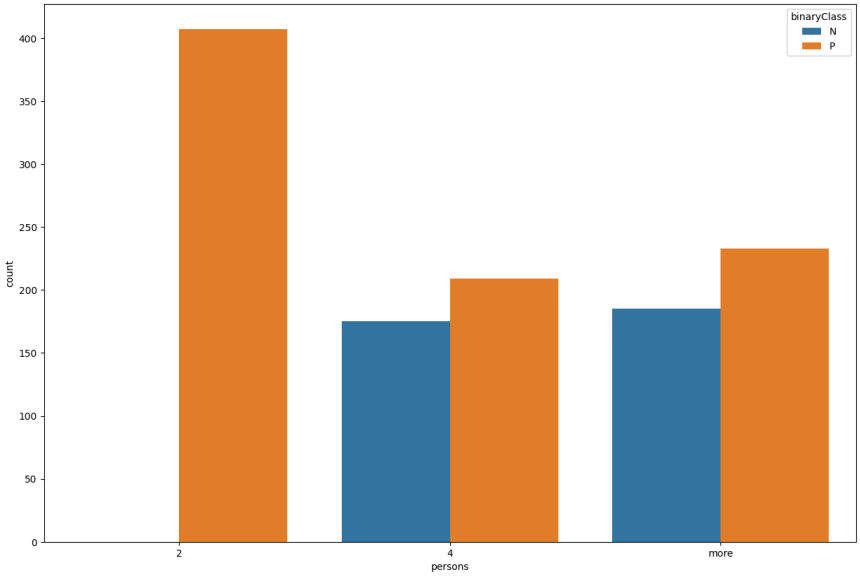



```
train_data['persons'].value_counts()
```

```
more    418
2       407
4       384
Name: persons, dtype: int64
```

```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='persons', hue='binaryClass')
```

```
<Axes: xlabel='persons', ylabel='count'>
```

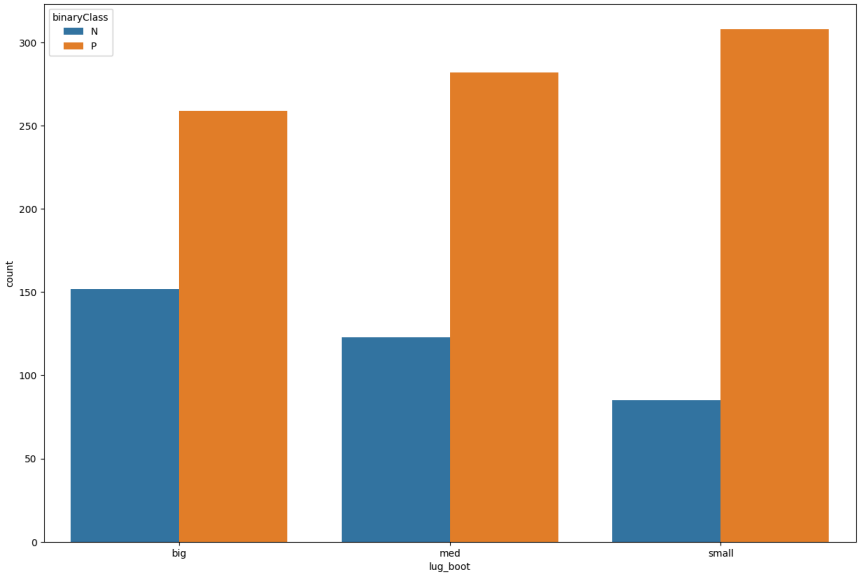



```
train_data['lug_boot'].value_counts()
```

```
big      411
med      405
small    393
Name: lug_boot, dtype: int64
```

```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='lug_boot', hue='binaryClass')
```

```
<Axes: xlabel='lug_boot', ylabel='count'>
```

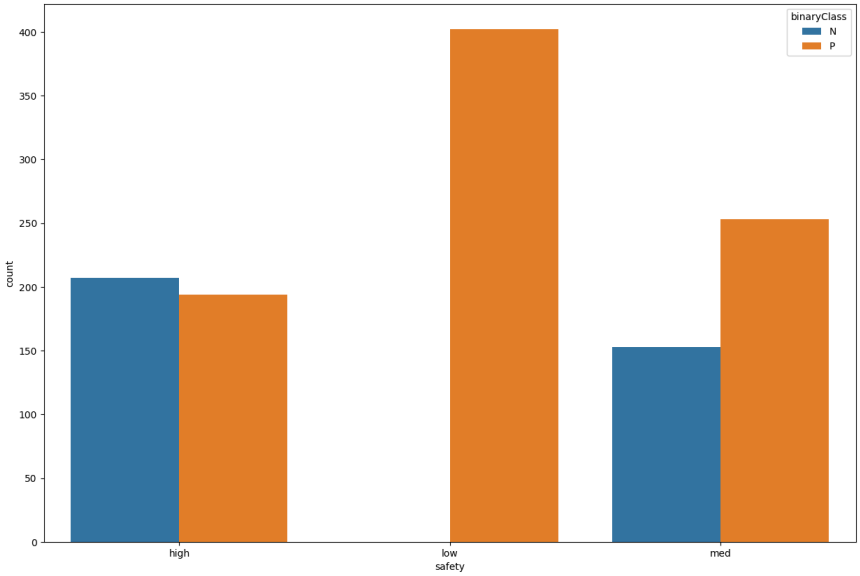



```
train_data['safety'].value_counts()
```

```
med     406
low     402
high    401
Name: safety, dtype: int64
```

```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='safety', hue='binaryClass')
```

```
<Axes: xlabel='safety', ylabel='count'>
```

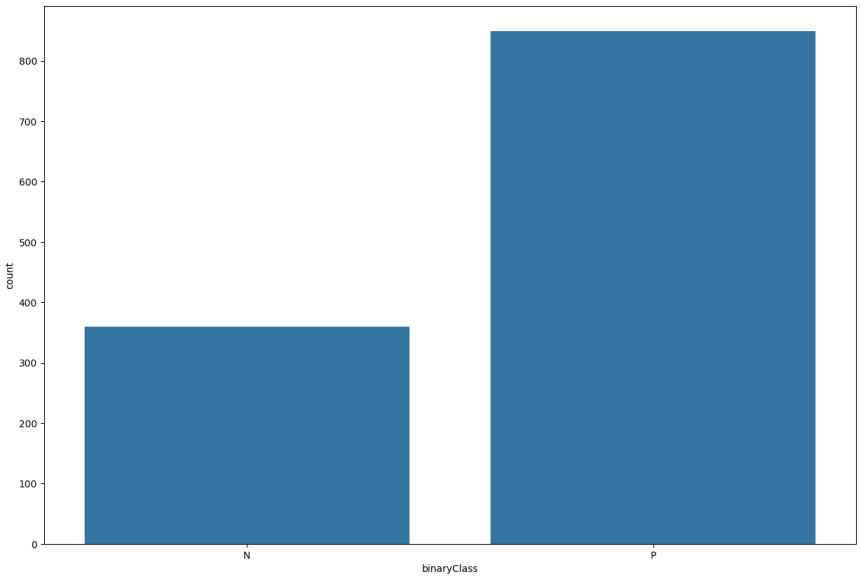



```
train_data['binaryClass'].value_counts()
```

```
P    849
N    360
Name: binaryClass, dtype: int64
```

```
plt.figure(figsize=(15,10))
sns.countplot(data=train_data, x='binaryClass')
```

```
<Axes: xlabel='binaryClass', ylabel='count'>
```




```
car_train = train_data.drop('binaryClass', axis=1)
car_labels = train_data[['binaryClass']]
```

```
from sklearn.preprocessing import OrdinalEncoder

from sklearn.pipeline import Pipeline

pipe = Pipeline([('ord_enc', OrdinalEncoder())])

car_train_prepared = pipe.fit_transform(car_train)
```

```
from sklearn.preprocessing import LabelEncoder

label_enc = LabelEncoder()

car_labels_prepared = label_enc.fit_transform(car_labels)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/preprocessing/_label.py:116: DataConversionWarning: A column-vector y was passed wh
  y = column_or_1d(y, warn=True)
```

```
from sklearn.tree import DecisionTreeClassifier

tree_clf = DecisionTreeClassifier()

tree_clf.fit(car_train_prepared, car_labels_prepared)
```

```
▾ DecisionTreeClassifier
DecisionTreeClassifier()
```

```
from sklearn import tree

# Assuming you have already trained a decision tree classifier called tree_clf

text_representation = tree.export_text(tree_clf)
print(text_representation)
```

```
|--- feature_3 <= 0.50
|   |--- class: 1
|--- feature_3 >  0.50
|   |--- feature_5 <= 0.50
|   |   |--- feature_0 <= 2.50
|   |   |   |--- feature_1 <= 2.50
|   |   |   |   |--- feature_2 <= 0.50
|   |   |   |   |   |--- feature_4 <= 1.50
|   |   |   |   |   |   |--- class: 0
|   |   |   |   |   |--- feature_4 >  1.50
|   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |--- class: 0
|   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |--- class: 1
|   |   |   |   |--- feature_2 >  0.50
|   |   |   |   |   |--- class: 0
|   |   |   |--- feature_1 >  2.50
|   |   |   |   |--- feature_0 <= 0.50
|   |   |   |   |   |--- class: 1
|   |   |   |   |--- feature_0 >  0.50
|   |   |   |   |   |--- feature_2 <= 0.50
|   |   |   |   |   |   |--- feature_4 <= 1.50
|   |   |   |   |   |   |   |--- class: 0
|   |   |   |   |   |   |--- feature_4 >  1.50
|   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |--- class: 0
|   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |--- class: 1
|   |   |   |   |   |--- feature_2 >  0.50
|   |   |   |   |   |   |--- class: 0
|   |   |--- feature_0 >  2.50
|   |   |   |--- feature_1 <= 0.50
|   |   |   |   |--- class: 1
|   |   |   |--- feature_1 >  0.50
|   |   |   |   |--- feature_1 <= 2.50
|   |   |   |   |   |--- feature_4 <= 1.50
|   |   |   |   |   |   |--- class: 0
|   |   |   |   |   |--- feature_4 >  1.50
|   |   |   |   |   |   |--- feature_2 <= 0.50
|   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |--- class: 0
|   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |--- class: 1
```