```python
In [3]:  import pandas as pd
         import numpy as np
         import matplotlib.pyplot as plt
         from scipy.special import gamma   # gamma function

         from sklearn.tree import DecisionTreeClassifier, plot_tree
         from sklearn.model_selection import train_test_split
         from sklearn.metrics import accuracy_score
```

```python
In [4]:  df = pd.read_csv("/content/student_exam_data.csv")
         df.head()
```

Out[4]:

	Study Hours	Previous Exam Score	Pass/Fail
0	4.370861	81.889703	0
1	9.556429	72.165782	1
2	7.587945	58.571657	0
3	6.387926	88.827701	1
4	2.404168	81.083870	0

```python
In [5]:  df['Pass/Fail'] = np.where(df['Study Hours'] < 2, 0, df['Pass/Fail'])
```

```python
In [6]:  # Transform features using gamma function
         df['StudyHours_Gamma'] = df['Study Hours'].apply(lambda x: gamma(x+1))  # gamm
         df['PrevScore_Gamma'] = df['Previous Exam Score'].apply(lambda x: gamma(x/10 +

         # Features and target
         X = df[['StudyHours_Gamma', 'PrevScore_Gamma']]
         y = df['Pass/Fail']
```

```python
In [7]:  X_train, X_test, y_train, y_test = train_test_split(
             X, y, test_size=0.2, random_state=42
         )
```

```python
In [8]:  DT = DecisionTreeClassifier(
             criterion='entropy',
             max_depth=4,
             random_state=42
         )
         DT.fit(X_train, y_train)
```

Out[8]:

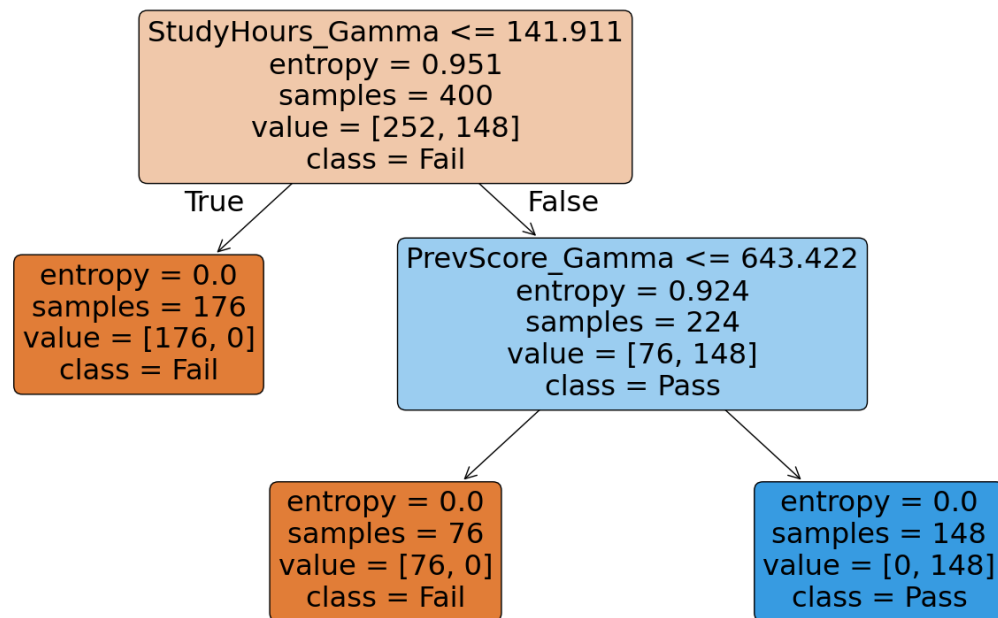▼   DecisionTreeClassifier   ⓘ ⓘ

DecisionTreeClassifier(criterion='entropy', max_depth=4, random_stat
e=42)

```python
In [9]:  y_pred = DT.predict(X_test)
```

```
accuracy = accuracy_score(y_test, y_pred)
print("Model Accuracy:", accuracy)
```

Model Accuracy: 0.99

In [10]:
```
plt.figure(figsize=(18, 10))
plot_tree(
    DT,
    feature_names=['StudyHours_Gamma', 'PrevScore_Gamma'],
    class_names=['Fail', 'Pass'],
    filled=True,
    rounded=True
)
plt.show()
```

```mermaid
graph TD
    A["StudyHours_Gamma <= 141.911<br/>entropy = 0.951<br/>samples = 400<br/>value = [252, 148]<br/>class = Fail"]
```

StudyHours_Gamma <= 141.911
entropy = 0.951
samples = 400
value = [252, 148]
class = Fail

True

entropy = 0.0
samples = 176
value = [176, 0]
class = Fail

False

PrevScore_Gamma <= 643.422
entropy = 0.924
samples = 224
value = [76, 148]
class = Pass

entropy = 0.0
samples = 76
value = [76, 0]
class = Fail

entropy = 0.0
samples = 148
value = [0, 148]
class = Pass

In [11]:
```
import pickle
with open("Decisiontree_gamma.pkl","wb") as f:
    pickle.dump(DT,f)
from google.colab import files
files.download('Decisiontree_gamma.pkl')
```