```python
import pandas as pd
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report, accuracy_score
import matplotlib.pyplot as plt

df =
pd.read_csv("/content/drive/MyDrive/datast/StudentMarksDataset.csv")

def Grade_class(marks):
    if marks >= 80:
        return "A"
    elif marks >= 70:
        return "B"
    else:
        return "C"

df["Grade"] = df["Std_Marks"].apply(Grade_class)

le = LabelEncoder()

df["Std_Branch"] = le.fit_transform(df["Std_Branch"])
df["Std_Course"] = le.fit_transform(df["Std_Course"])
df["Std_Name"] = le.fit_transform(df["Std_Name"])
df["Std_RollNo"] = le.fit_transform(df["Std_RollNo"])
df["Grade"] = le.fit_transform(df["Grade"])

X = df[["Std_Branch", "Std_Course", "Std_Marks"]]
y = df["Grade"]

X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.25, random_state=42
)

rf = RandomForestClassifier(
    n_estimators=100,
    criterion="entropy",
    random_state=42
)

rf.fit(X_train, y_train)
```

```
RandomForestClassifier(criterion='entropy', random_state=42)
```

```python
y_pred = rf.predict(X_test)

print("Random Forest Accuracy:", accuracy_score(y_test, y_pred))
print("\nClassification Report:\n")
print(classification_report(y_test, y_pred))
```

```
Random Forest Accuracy: 0.98

Classification Report:

              precision    recall  f1-score   support

           0       1.00      1.00      1.00        19
           1       0.97      1.00      0.98        30
           2       0.00      0.00      0.00         1

    accuracy                           0.98        50
   macro avg       0.66      0.67      0.66        50
weighted avg       0.96      0.98      0.97        50


/usr/local/lib/python3.12/dist-packages/sklearn/metrics/
_classification.py:1565: UndefinedMetricWarning: Precision is ill-
defined and being set to 0.0 in labels with no predicted samples. Use
`zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
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  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
```

```python
importances = rf.feature_importances_
for feature, importance in zip(X.columns, importances):
    print(f"{feature}: {importance:.3f}")
```

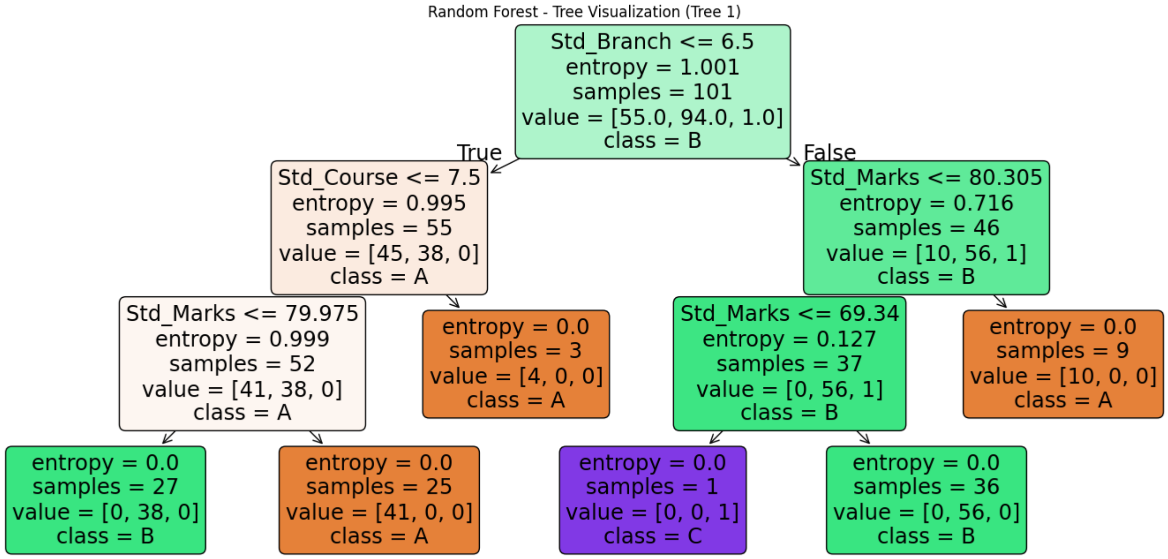
```
Std_Branch: 0.088
Std_Course: 0.053
Std_Marks: 0.859
```

```python
from sklearn.tree import plot_tree

plt.figure(figsize=(18, 8))

plot_tree(
    rf.estimators_[0],        # first tree in the forest
    feature_names=X.columns,
    class_names=["A", "B", "C"],
    filled=True,
    rounded=True
)

plt.title("Random Forest - Tree Visualization (Tree 1)")
plt.show()
```


Random Forest - Tree Visualization (Tree 1)
Std_Branch <= 6.5
entropy = 1.001
samples = 101
value = [55.0, 94.0, 1.0]
class = B
True
False
Std_Course <= 7.5
entropy = 0.995
samples = 55
value = [45, 38, 0]
class = A
Std_Marks <= 80.305
entropy = 0.716
samples = 46
value = [10, 56, 1]
class = B
Std_Marks <= 79.975
entropy = 0.999
samples = 52
value = [41, 38, 0]
class = A
entropy = 0.0
samples = 3
value = [4, 0, 0]
class = A
Std_Marks <= 69.34
entropy = 0.127
samples = 37
value = [0, 56, 1]
class = B
entropy = 0.0
samples = 9
value = [10, 0, 0]
class = A
entropy = 0.0
samples = 27
value = [0, 38, 0]
class = B
entropy = 0.0
samples = 25
value = [41, 0, 0]
class = A
entropy = 0.0
samples = 1
value = [0, 0, 1]
class = C
entropy = 0.0
samples = 36
value = [0, 56, 0]
class = B