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import math
from collections import Counter

data = [
    ['Sunny', 'Hot', 'High', 'Weak', 'No'],
    ['Sunny', 'Hot', 'High', 'Strong', 'No'],
    ['Overcast', 'Hot', 'High', 'Weak', 'Yes'],
    ['Rain', 'Mild', 'High', 'Weak', 'Yes'],
    ['Rain', 'Cool', 'Normal', 'Weak', 'Yes'],
    ['Rain', 'Cool', 'Normal', 'Strong', 'No'],
    ['Overcast', 'Cool', 'Normal', 'Strong', 'Yes'],
    ['Sunny', 'Mild', 'High', 'Weak', 'No'],
    ['Sunny', 'Cool', 'Normal', 'Weak', 'Yes'],
    ['Rain', 'Mild', 'Normal', 'Weak', 'Yes'],
    ['Sunny', 'Mild', 'Normal', 'Strong', 'Yes'],
    ['Overcast', 'Mild', 'High', 'Strong', 'Yes'],
    ['Overcast', 'Hot', 'Normal', 'Weak', 'Yes'],
    ['Rain', 'Mild', 'High', 'Strong', 'No']
]

attrs = ['Outlook', 'Temp', 'Humidity', 'Wind']

entropy = lambda d: -sum((c/len(d))*math.log2(c/len(d))
    for c in Counter(r[-1] for r in d).values())

gain = lambda d,i: entropy(d) - sum(
    (len(s)/len(d))*entropy(s)
    for v in set(r[i] for r in d)
        for s in [[r for r in d if r[i]==v]])
)

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def id3(d, a):
    if len(set(r[-1] for r in d)) == 1:
        return d[0][-1]
    if not a:
        return Counter(r[-1] for r in d).most_common(1)[0][0]

    i = max(range(len(a)), key=lambda x: gain(d, x))
    return {a[i]: {v: id3([r[:i]+r[i+1:] for r in d if r[i]==v],
                           a[:i]+a[i+1:])
                   for v in set(r[i] for r in d)}}

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def classify(t, a, x):
    return t if not isinstance(t, dict) else classify(
        t[next(iter(t))][x[a.index(next(iter(t)))]], a, x)

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tree = id3(data, attrs)
print("Decision Tree:", tree)

sample = ['Sunny', 'Cool', 'High', 'Strong']
print("Prediction:", classify(tree, attrs, sample))

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OUTPUT:

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IDLE Shell 3.13.9
File Edit Shell Debug Options Window Help
Python 3.13.9 (tags/v3.13.9:8183fa5, Oct 14 2025, 14:09:13) [MSC v.1944 64 bit (AMD64)] on win32
Enter "help" below or click "Help" above for more information.
>>> ===== RESTART: C:/Users/prast/OneDrive/Desktop/ML LAB/EXP 3.py =====
Decision Tree: {'Outlook': {'Overcast': 'Yes', 'Rain': {'Wind': {'Strong': 'No', 'Weak': 'Yes'}}, 'Sunny': {'Humidity': {'Normal': 'Yes', 'High': 'No'}}}}
Prediction: No

```