Assignment Solution: Decision Tree (ID3)

Step 1 — Base entropy
In the full set, Yes = 5, No = 5 (10 examples).
H(S) = -5/10 log2(5/10) - 5/10 log2(5/10) = 1.000

Step 2 — Information Gain for each attribute
A) Outlook
Sunny (4): Yes=1, No=3 → H≈0.811
Overcast (2): Yes=2, No=0 → H=0
Rain (4): Yes=2, No=2 → H=1.000
Weighted remainder ≈ 0.724
Gain(Outlook) = 1.000 - 0.724 ≈ 0.276

B) Temperature
Gain(Temperature) ≈ 0.125

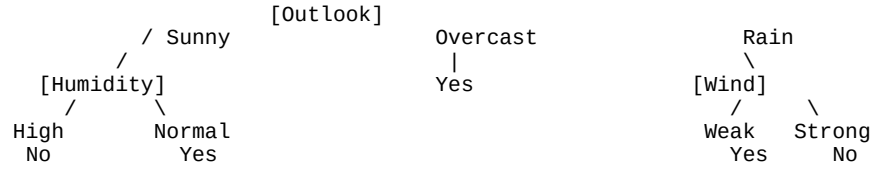
C) Humidity
Gain(Humidity) ≈ 0.029

D) Wind
Gain(Wind) ≈ 0.125

Best root split: **Outlook** (highest gain).

Step 3 — Split on Outlook
• Outlook = Overcast → Play = Yes
• Outlook = Sunny → Split on Humidity:
  Humidity = High → No
  Humidity = Normal → Yes
• Outlook = Rain → Split on Wind:
  Wind = Weak → Yes
  Wind = Strong → No

Final Decision Tree:



Rule set:
1. If Outlook = Overcast → Play = Yes
2. If Outlook = Sunny and Humidity = High → Play = No
3. If Outlook = Sunny and Humidity = Normal → Play = Yes
4. If Outlook = Rain and Wind = Weak → Play = Yes
5. If Outlook = Rain and Wind = Strong → Play = No