1. **[Calculate the entropy if Temp is used as the top node.](https://uwm.courses.wisconsin.edu/d2l/le/680511/discussions/topics/621937/View)**

**Temp**

**Hot (2,2) Mild (4,2) Cool (3,1)**

Yes

No

Yes

Yes

Yes

No

Yes

No

Yes

Yes

No

No

Yes

Yes

No

Entropy for Temperature is,

Entropy(Temp) = info([2,2], [4,2], [3,1])

= (4/14) \* info([2,2]) + (6/14) \* info([4,2]) + (4/14) \* info([3,1])

= 0.2857\*1.000 + 0.4286\*0.918 + 0.2857\*0.811

= 0.2857 + 0.3935 + 0.2317

**= 0.9109**

1. [**Calculate the entropy if Humidity is used as the top node.**](https://uwm.courses.wisconsin.edu/d2l/le/680511/discussions/topics/621938/View)

**Humidity**

**High (3,4) Normal (6,1)**

Yes

No

Yes

Yes

Yes

Yes

Yes

No

No

Yes

Yes

No

Yes

No

No

Entropy for Humidity is,

Entropy(Humidity) = info([3,4], [6,1])

= (7/14) \* info([3, 4]) + (7/14) \* info([6, 1])

= 0.5\*0.985 + 0.5\*0.592

= 0.4925 + 0.296

**= 0.7885**

1. [**Calculate the entropy if Windy is used as the top node.**](https://uwm.courses.wisconsin.edu/d2l/le/680511/discussions/topics/621939/View)

**Windy**

**False (6,2) True (3,3)**

No

No

Yes

Yes

Yes

No

No

Yes

Yes

Yes

No

Yes

Yes

Yes

No

Entropy for Windy is,

Entropy(Windy) = info([6,2], [3,3])

= (8/14) \* info([6, 2]) + (6/14) \* info([3, 3])

= 0.57142\*0.811 + 0.42857\*1.000

= 0.46342 + 0.42857

**= 0.89199**

1. [**If Outlook is the top node, and Windy is the next attribute selected on the Outlook = sunny branch, what's the entropy?**](https://uwm.courses.wisconsin.edu/d2l/le/680511/discussions/topics/621940/View)

**Outlook**

**Sunny**

**Windy**

**True (1,1)** **False (1,2)**

No

No

Yes

No

Yes

Entropy for Outlook=Sunny and Windy is,

Entropy(Outlook=Sunny and Windy)=info([1,1], [1,2])

= 2/5\*info([1,1]) + 3/5\*info([1,2])

= 0.4\*1.000 + 0.6\*0.918

= 0.4 + 0.5508

=**0.9508**

1. [**If Outlook = sunny and then Temp is selected, what's the entropy?**](https://uwm.courses.wisconsin.edu/d2l/le/680511/discussions/topics/621941/View)

**Outlook**

**Sunny**

**Temp**

**Hot (0,2)** **Mild (1,1) Cool(1,0)**

Yes

No

Yes

No

No

Entropy for Outlook=Sunny and Temp is,

Entropy(Outlook=Sunny and Temp)=info([0,2], [1,1], [1,0])

= 2/5\*info([0,2]) + 2/5\*info([1,1]) + 1/5\*info([1,0])

= 0.4\*1.000

=0.4

1. [**If Outlook = sunny and then Humidity is selected, what's the entropy?**](https://uwm.courses.wisconsin.edu/d2l/le/680511/discussions/topics/621942/View)

**Outlook**

**Sunny**

**Humidity**

**High (0,3)** **Normal (2,0)**

No

No

No

Yes

Yes

Entropy for Outlook=Sunny and Humidity is,

Entropy(Outlook=Sunny and Humidity)=info([0,3], [2,0])

= 3/5\*info([0,3]) + 2/5\*info([2,0])

= 0

1. [**If Outlook = rainy and then Windy is selected, what's the entropy?**](https://uwm.courses.wisconsin.edu/d2l/le/680511/discussions/topics/621943/View)

**Outlook**

**Rainy**

**Windy**

**True (0,2)** **False (3,0)**

No

No

Yes

Yes

Yes

Entropy for Outlook = rainy and Windy is,

Entropy(Outlook = rainy and Windy)=info([0,2], [3,0])

= 2/5\*info([0,2]) + 3/5\*info([3,0])

= 0

1. [**What's the final decision tree that C4.5 will generate based on entropy?**](https://uwm.courses.wisconsin.edu/d2l/le/680511/discussions/topics/621944/View)

**Explanation:**

1. **Selecting target attribute:**

The entropies for the attributes Temperature, Humidity, Windy and Outlook are 0.9109, 0.7885, 0.8919 and 0.6932.

The information gain for these attributes are,









The attribute that has greatest information gain and least entropy is **“Outlook”**. Thus, Outlook becomes the top node or target attribute.

1. **Selecting sub-attribute:**

For sub nodes the entropies are,

Outlook=Sunny & Windy is 0.9508

Outlook=Sunny and Temp is 0.4

Outlook=Sunny and Humidity is 0

Since the Humidity has least entropy, it is selected as a sub-node.

The entropies for, Outlook=Rainy & Windy is 0.

Outlook= Rainy and Temp is 0.3394

Outlook= Rainy and Humidity is 0.3394

Thus, Windy is selected as the other sub-node as it has least entropy.

The set of rules generated by mapping the root node are,

**R1:** If Outlook=Sunny & Humidity=high Then **PLAY = NO**

**R2:** If Outlook=Sunny & Humidity=Normal Then **PLAY = YES**

**R3:** If Outlook=Overcast Then **PLAY = YES**

**R4:** If Outlook=Rainy & Windy=False Then **PLAY = YES**

**R5:** If Outlook=Rainy & Windy=True Then **PLAY = NO**