Decision Tree Quiz

Due No due date   **Points** 7   **Questions** 7   **Time Limit** None
Allowed Attempts Unlimited

Attempt History

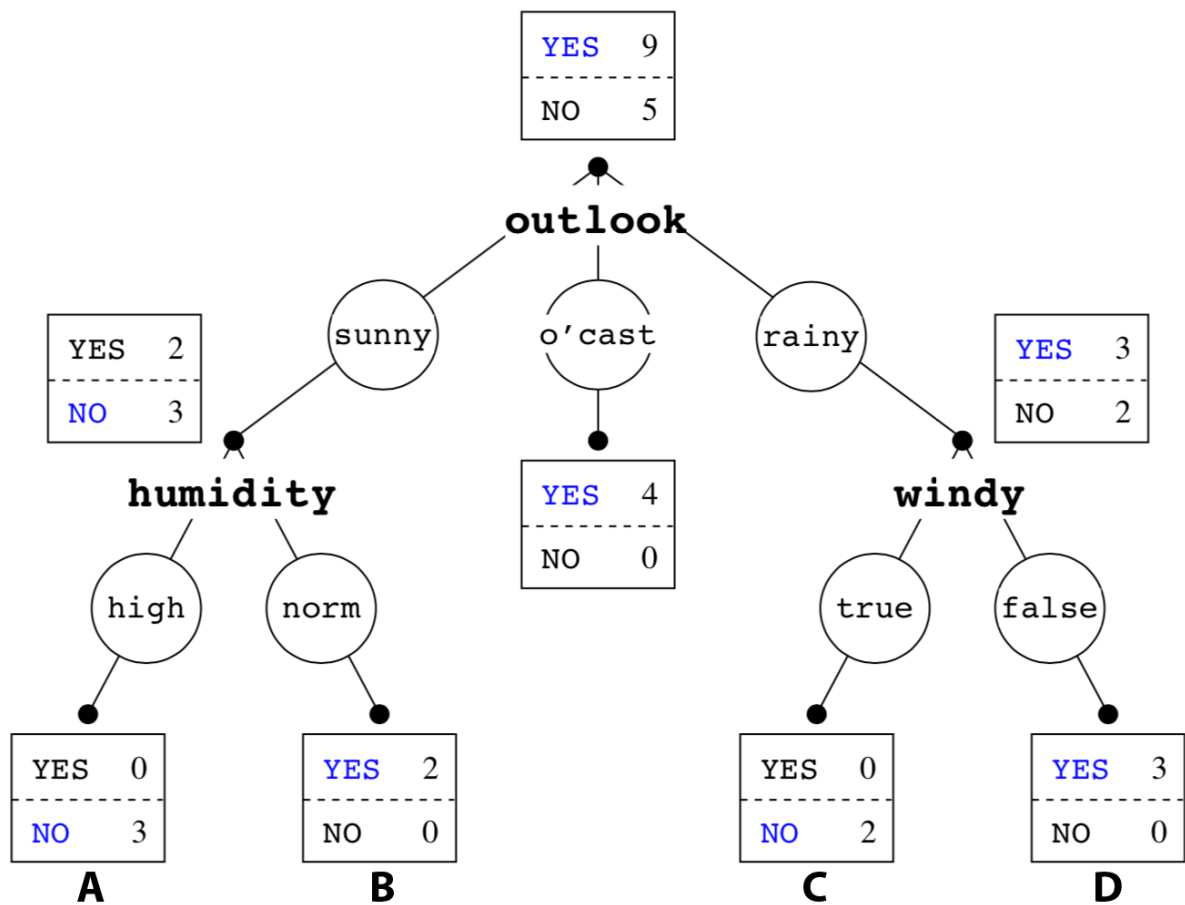|	Attempt	Time	Score
LATEST	Attempt 1	less than 1 minute	0 out of 7

Submitted Jun 16 at 18:18

Unanswered

Question 1   0 / 1 pts

Consider how the decision tree shown below will classify the test instance
Outlook=rainy, Temp=mild, Humidity=normal, Windy=true? Which node
will be used to determine the class?

Decision tree with root **outlook** (YES 9, NO 5) branching to:
- **sunny** → **humidity** (YES 2, NO 3)
  - **high** → A (YES 0, NO 3)
  - **norm** → B (YES 2, NO 0)
- **o'cast** → YES 4, NO 0
- **rainy** → **windy** (YES 3, NO 2)
  - **true** → C (YES 0, NO 2)
  - **false** → D (YES 3, NO 0)

- ○ B

- ○ C

- ○ A

- ○ D

The first decision is based on Outlook, and the algorithm takes the rightmost branch (rainy). The next decision is based on Windy, and the algorithm takes the left branch (true) to end up at node C

Question 2

0 / 1 pts

Can a decision tree classify an entire training set with zero errors?

○ No, Never

○
Yes, if the number of attributes is equal to or greater than logc(N) for N training instances and c classes

○ Yes, always

○
Yes, if every training instance has a unique combination of attribute values

A decision tree can classify an entire training set correctly so long as there are no instances which have exactly the same attribute values but different classes. If every instance has a unique combination of attribute values this is guaranteed not to happen. Classifying an entire training set correctly may require a very large tree!

Question 3

0 / 1 pts

What is the maximum possible height of a decision tree?

○ The number of attributes * the number of levels per attribute

○ log(number of instances)

○ The number of attributes

○ log(number of attributes)

The longest possible branch in a decision tree would consider every attribute exactly once before making a final classification decision. So the maximum possible height of a tree is the same as the number of attributes.

Question 4

For the next two questions, consider the following dataset, which has four attributes (Outlook, Temperature, Humidity, Windy). The class to predict is Play.

Outlook	Temperature	Humidity	Windy	Play?
Sunny	Hot	High	True	Yes
Partly cloudy	Hot	Low	False	Yes
Overcast	Cool	Low	True	Yes
Heavy cloud	Cool	Low	False	Yes
Showers	Hot	Low	True	No
Rainy	Hot	High	False	No
Hail	Cool	High	True	No
Snow	Cool	High	False	No

Which attribute has the highest information gain?

○ Humidity

○ Temperature

○ Windy

○ Outlook

Outlook has information gain = 1 - 0 = 1. It can perfectly predict class (if only because every instance in the dataset has a different Outlook). The next best attribute is Humidity, which has information gain = 1 - 0.8113 = 0.1887. Temperature and Windy each have information gain = 1 - 1 = 0.

Question 5

0 / 1 pts

Which attribute has the highest gain ratio?

- ○ Outlook

- ○ Temperature

- ○ Humidity

- ○ Windy

Outlook has gain ratio 1 / 3 = 0.33, while humidity has gain ratio 0.1887 / 1 = 0.1887. Temperature and Windy each have information gain of 0, so they have gain ratio of 0.

Question 6

0 / 1 pts

Which of the following statements are true of decision trees? Select all which are true.

☐ The final nodes (leaves) of the tree are guaranteed to have only one class.

☐ Decision trees cannot handle attributes with missing values.

☐ Different branches of a tree may use different attributes to arrive at a final decision.

☐ There is no way to include continuous attributes in a decision tree.

Decision trees can handle missing values – generally, if the algorithm hits a missing attribute, it will continue down all branches and do some kind of averaging/aggregating of the final decisions. Continuous attributes can be included in a decision tree by discretising these attributes, or splitting based on a threshold. Some types of decision trees (e.g., oblivious decision trees) require every branch to use the same attributes, but this is not required in general. The final nodes of a decision tree may include instances with different classes.

Question 7

0 / 1 pts

Which of the following criteria may be used to terminate a branch in a decision tree? (Select all criteria which may be used.)

☐ c) All of the instances at this node have the same class

☐ d) The information gain becomes negative

☐ b) The information gain drops below a threshold

☐ a) All attributes have been used

The decision tree will stop branching once all attributes are used or the decision grain drops below a threshold. When all instances are the same class, the mean info is zero and it is not possible for another branching to yield any further information gain, so this case would be included in the case where the information gain drops below a threshold. Information gain would never drop below zero, so this can't be used as a stopping condition.