Review Test Submission: Concept Learning

User	Fei Shen
Course	CS-584-Parent.17S
Test	Concept Learning
Started	1/15/17 9:58 PM
Submitted	1/19/17 8:19 PM
Due Date	1/19/17 11:59 PM
Status	Completed
Attempt Score	43 out of 60 points
Time Elapsed	94 hours, 20 minutes
Results Displayed	Submitted Answers, Correct Answers

Question 1

10 out of 10 points

Consider a learning problem with n binary-valued attributes. Give a formula for the total number of concepts can be represented using these attributes? (I.e., how big is the full unbiased hypothesis space?)

Selected Answer: 2^{2^n}

Correct Answer: 2^{2^n}

Question 2

10 out of 10 points

Consider a learning problem with n binary-valued attributes. How many conjunctive hypotheses are there?

Selected Answer: 3^n+1

Correct Answer: 3^n+1

Question 3

10 out of 10 points

Assume a hypothesis space H contains only conjunctive hypotheses over n attributes. Given a training set $\{x_1, ..., x_k\}$ of positive examples, how large can S be? (I.e., what is the maximum number of most specific hypotheses?)

Selected Answer: 1

Correct Answer: 1

Question 4

3 out of 10 points

Consider a hypothesis space for representing concepts related to what diseases a tomato plant might have. Plants are represented via four attributes: Leaf-Color, Tomato-Size, Tomato-Taste, and Number-of-Seeds. The possible values of these attributes are as follows:

- Leaf-Color: *normal, yellow, black*
- Tomato-Size: *small, normal*
- Tomato-Skin: *smooth, wrinkled, bumpy*
- Number-of-Seeds: *very-few, few, many, very-many*

Hypotheses are conjunctions of constraints on attribute values, where a constraint can be either an equality constraint (e.g., Leaf-Color=*yellow*) or one of the following set constraints:

- Leaf-Color=*abnormal*
  - Leaf-Color=*yellow* OR Leaf-Color=*black*
- Number-of-Seeds=*less*
  - Number-of-Seeds=*few* OR Number-of-Seeds=*very-few*
- Number-of-Seeds=*more*
  - Number-of-Seeds=*many* OR Number-of-Seeds=*very-many*

What are the minimal generalizations from the hypothesis:

Leaf-Color=*black* AND Tomato-Size=*small* AND Tomato-Skin=*bumpy* AND Number-of-Seeds=*very-few*

Selected Answers:
- Leaf-Color=*abnormal* AND Tomato-Size=*small* AND Tomato-Skin=*bumpy* AND Number-of-Seeds=*very-few*
- (Leaf-Color=*black* OR Leaf-Color=*yellow)* AND Tomato-Size=*small* AND Tomato-Skin=*bumpy* AND Number-of-Seeds=*very-few*
- Leaf-Color=*black* AND Tomato-Size=*small* AND Tomato-Skin=*bumpy* AND Number-of-Seeds=*less*

Correct Answers:
- Leaf-Color=*abnormal* AND Tomato-Size=*small* AND Tomato-Skin=*bumpy* AND Number-of-Seeds=*very-few*
- Leaf-Color=*black* AND Tomato-Skin=*bumpy* AND Number-of-Seeds=*very-few*
- Leaf-Color=*black* AND Tomato-Size=*small* AND Tomato-Skin=*bumpy* AND Number-of-Seeds=*less*
- Leaf-Color=*black* AND Tomato-Size=*small* AND Number-of-Seeds=*very-few*

Question 5

0 out of 10 points

Consider a hypothesis space for representing concepts related to what diseases a tomato plant might have. Plants are represented via four attributes: Leaf-Color, Tomato-Size, Tomato-Taste, and Number-of-Seeds. The possible values of these attributes are as follows:

- Leaf-Color: *normal, yellow, black*
- Tomato-Size: *small, normal*
- Tomato-Skin: *smooth, wrinkled, bumpy*
- Number-of-Seeds: *very-few, few, many, very-many*

Hypotheses are conjunctions of constraints on attribute values, where a constraint can be either an equality constraint (e.g., Leaf-Color=*yellow*) or one of the following set constraints:

- Leaf-Color=*abnormal*
  - Leaf-Color=*yellow* OR Leaf-Color=*black*
- Number-of-Seeds=*less*
  - Number-of-Seeds=*few* OR Number-of-Seeds=*very-few*
- Number-of-Seeds=*more*
  - Number-of-Seeds=*many* OR Number-of-Seeds=*very-many*

Given this hypothesis space and a set of **positive** examples, is there always a single **unique** most specific hypothesis in the version space (i.e., never more than one)?

Selected Answer: ✗ True
Correct Answer: ✓ False

Question 6

10 out of 10 points

Consider the instance space X of points **x** = (x_1, x_2) with **integer** coordinates([0..10], [0..10]) ⊂ N^2 . The task is to learn a concept c : X → {0, 1} which can be described as a rectangle ((a, b), (c, d)) ∈ N^2× N^2 where (a, b) is the lower left corner of the rectangle, (c, d) is the upper right corner. An example is labeled positive if it lies inside the rectangle or on its boundary, and negative, if it lies outside the rectangle.

The hypothesis space H are all rectangles over the instance space X. Note that in this setting, a hypothesis *h*= ((a, b),(c, d)) can be generalized by decreasing a or b and/or increasing c or d. Similarly it can be made more specific by increasing a or b or decreasing c or d.

Consider the following training set, where the 0 or 1 is the label of each data point (0 indicates negative examples, and 1 indicates positive examples):

((0, 5), 0)

((4, 5), 1)

((2, 2), 0)

((9, 5), 0)

((6, 3), 1)

((5, 6), 1)

((7, 0), 0)

((5, 8), 0)

For this training set, what rectangles are in the G boundary of the version space?

Selected Answers: ✓ ((1, 3), (8, 7))
✓ ((3, 1), (8, 7))
✓ ((3, 0), (6, 7))
Correct Answers: ✓ ((1, 3), (8, 7))
✓ ((3, 1), (8, 7))
✓ ((3, 0), (6, 7))

Monday, May 1, 2017 2:44:57 PM CDT

← OK