Problem Set 7: Due April 16

Outlook	Temp	Humidity	Wind	Play?
Sunny	Hot	High	Weak	No
Sunny	Hot	High	Strong	No
Overcast	Hot	High	Weak	Yes
Rain	Hot	High	Weak	Yes
Rain	Mild	High	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

Figure 1: When to play tennis?

1. (15 points) Use the Information Gain function covered in the book (chapter 18) and in class to build a decision tree with the tennis data in Figure 1. When adding a node, show the Information Gain for each potential attribute; the best one should become a labeled node in the decision tree.

2. (10 points) Can you build a shorter decision tree with this data manually? If so, illustrate it.

3. (10 points) Let's say I want to add more training information to an existing decision tree. One approach would be to use the existing decision tree; if the final decision was incorrect, we could then add nodes (below the current leaf) to test features (that weren't yet tested) on the new training data and thereby return the desired results. Why is this a bad idea?

4. (15 points) Use the perceptron learning rule to build a perceptron that implements the logical function $A \vee \neg B$. Assume the perceptron has two inputs (for A and B respectively) and one output. Clearly indicate your initial weights and the learning rate α. Show you work and the final weights.

5. (10 points) A single perceptron cannot encode the XOR function. Can we hook two perceptrons up (so the two perceptrons are used as input to a third perceptron) to encode this function? If so, show the a set of weights that would work, if not provide a compelling argument.