CSCI/ARTI 8950 Machine Learning

Assignment Number 1: Due 2/7/2019 **(in class)**

1. **[20 points]**

   The goal of the Chess game is to take out the King piece of the apponent. If you never played it or need more information about it, please visit http://en.wikipedia.org/wiki/Chess or search for other sites on the web. Our objective in this problem is to learn a good strategy to play Chess.

   Formulate the Chess learning as a machine learning problem. You should briefly describe:

   - What exactly would be learned and how it would be represented
   - How the training examples will be obtained
   - Which learning algorithm will be used

2. **[10 points]** Solve problem 2.4 on page 48 of the text book.

3. **[10 points][Mid]** Consider the EnjoySport concept learning task defined in Table 2.2 of the textbook.

   (a) Give a minimum length sequence of training examples that produces the following version space (represented by its S and G sets):

   ```
   S:{< ?  Warm   Normal   Strong   Cool   ?>}
   G:{< ?    ?      ?         ?       ?    ?>}
   ```

   (b) Give a minimum length sequence of **additional** training examples that will transform the version space described above into the following version space:

   ```
   S:{< ?  Warm   Normal   Strong   Cool   ?>}
   G:{< ?    ?    Normal   Strong     ?    ?>}
   ```

4. **[10 points][Mid]** Consider the following examples for machine learning:

Example	a1	a2	a3	a4	a5	label
1	1	0	0	0	1	+
2	1	1	1	0	0	+
3	0	0	0	1	1	−
4	1	0	1	0	0	+

Each hypothesis is described by a conjunction of constraints on the attributes **a1** through **a5**. The constraints may be "$*$" (any value is acceptable), "ϕ" (no value is acceptable), or a specific value (i.e. 0 or 1).

(a) Give the sequence of S and G boundary sets computed by the **Candidate-Elimination** algorithm going through the given examples in the given order.

(b) Would the final version space obtained above change if the examples were considered in reverse order? Briefly explain why.

(c) Give a minimum length sequence of **additional** training examples that will make the version space converge to one and only one hypothesis.