Homework 5 Solutions
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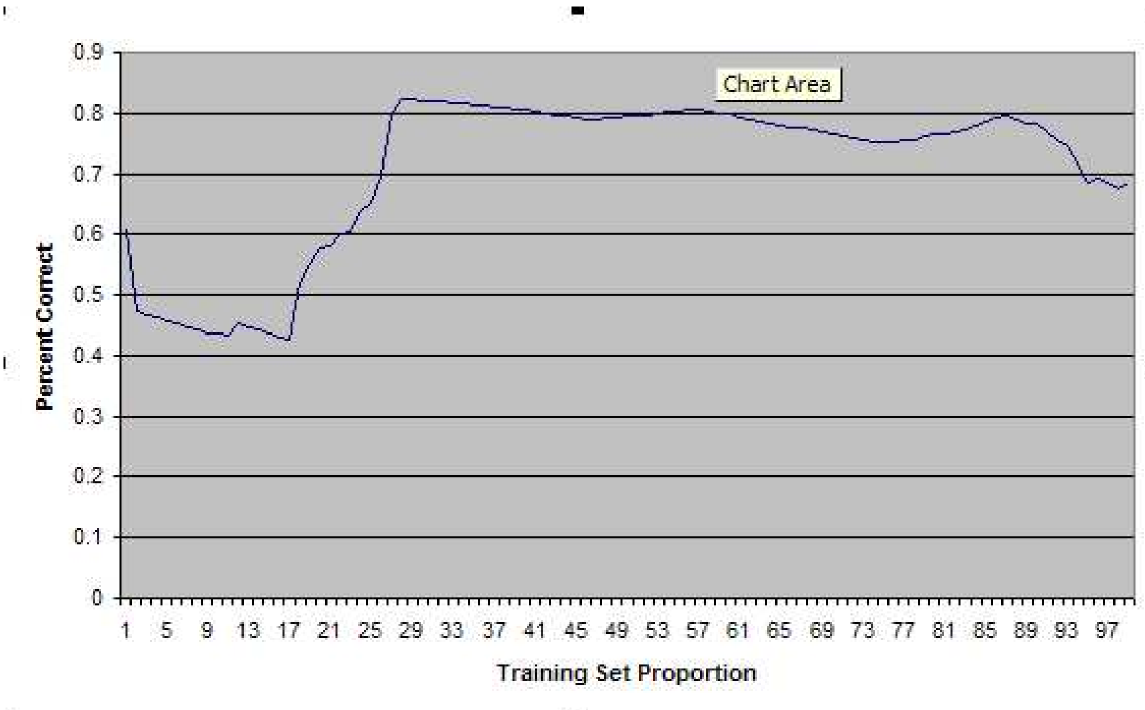
1.

The below graph shows the learning curve for various training/test set sizes. For this particular set of data there is no "correct" answer for some attribute combinations, and thus there is always some residual error.



2. Figure 20.17 of your book shows how to construct **AND**, **OR**, and **NOT** gates using a threshold perceptron. To construct a three input **XOR** gate we can then simply create a logical expression using only those three gates. Thus we have

   $(A \wedge \neg B \wedge \neg C) \vee (\neg A \wedge B \wedge \neg C) \vee (\neg A \wedge \neg B \wedge C) \vee (A \wedge B \wedge C)$

   Since this expression uses only **AND**, **OR**, and **NOT** gates, simply use the activation weights from Figure 20.17 to create a neural network representing it.

3. When attempting to learn the parity function on four inputs, a simple threshold perceptron fails as expected. As examples of the parity function are fed into the perceptron the weights should fluctuate around 0 if the bias weight is -1 and the inputs are either 0 or 1. Some of the weights will be slightly positive while others are slightly negative. This is simply an artifact of the iterative nature of the learning process when confronted by an "unlearnable" problem.