WORKSHEET FOR EXERCISES FROM CHAPTER 11

EXERCISE 11.1

1. **What is the total SSE for the network after training has finished?**

2. **How many epochs of training occurred before the program stopped training the network?**

3. **When the Delta rule is used in the Rosenblatt program, the step activation function is being used in the output units. The unit will only turn on when its net input exceeds the unit's threshold or bias. Armed with this knowledge, look at the two connection weights that feed into the first output unit, and look at the bias of this output unit. Explain how this output unit computes the AND of *A* and *B*.**

4. **Look at the two connection weights that feed into the second output unit, and look at the bias of this output unit. Explain how this output unit computes the OR of *A* and *B*.**

5. **Look at the two connection weights that feed into the third output unit, and look at the bias of this output unit. Explain how this output unit INVERTS the signal from *A*.**

6. **Look at the two connection weights that feed into the fourth output unit, and look at the bias of this output unit. Explain how this output unit INVERTS the signal from *B*.**

EXERCISE 11.2

1. **What is the total SSE for the network after training has finished?**

2. **How many epochs of training occurred before the program stopped training the network?**

3. **How do your answers to questions 1 and 2 above compare to your answers to questions 1 and 2 in Exercise 11.1? If the answers are different, provide a brief explanation of why this is to be expected.**

4. **When the gradient descent rule is used in the Rosenblatt program, the logistic activation function is being used in the output units. Armed with this knowledge, look at the two connection weights that feed into the first output unit, and look at the bias of this output unit. Explain how this output unit computes the AND of *A* and *B*. How does this explanation compare to the explanation of AND that you provided for the perceptron that was trained with the Delta rule?**

5. **Look at the two connection weights that feed into the second output unit, and look at the bias of this output unit. Explain how this output unit computes the OR of *A* and *B*. How does this explanation compare to the explanation of OR that you provided for the perceptron that was trained with the Delta rule?**

6. **Look at the two connection weights that feed into the third output unit, and look at the bias of this output unit. Explain how this output unit INVERTS the signal from *A*. How does this explanation compare to the explanation of INVERT that you provided for the perceptron that was trained with the Delta rule?**

EXERCISE 11.3

1. **What is the total SSE for the network after training has finished?**

2. **How many epochs of training occurred before the program stopped training the network?**

3. **Examine the responses of the network to each pattern, and the errors computed for each output unit for each pattern. In what way is the network behaving correctly? In what way is the network making mistakes?**

4. **With the default settings, and with thresholds held constant during training, every output unit always has a threshold of 0. Armed with this knowledge, examine the connection weights that feed into any output unit that is generating errors. Explain why any errors are being made.**

5. **Given your answer to question 4, speculate on the role of the threshold in the perceptron, and speculate on why it might be important to let the learning rule train thresholds in addition to training the connection weights.**