PROBLEMS

11.1 **Credit Card Use.** Consider the hypothetical bank data in Table 11.8 on consumers' use of credit card credit facilities. Create a small worksheet in Excel, like that used in Example 1, to illustrate one pass through a simple neural network.

TABLE 11.8	DATA FOR CREDIT CARD EXAMPLE AND VARIABLE DESCRIPTIONS	
Years	**Salary**	**Used Credit**
4	43	0
18	65	1
1	53	0
3	95	0
15	88	1
6	112	1

Years: number of years the customer has been with the bank
Salary: customer's salary (in thousands of dollars)
Used Credit: 1 = customer has left an unpaid credit card balance at the end of at least one month in the prior year, 0 = balance was paid off at the end of each month

11.2 **Neural Net Evolution.** A neural net typically starts out with random coefficients; hence, it produces essentially random predictions when presented with its first case. What is the key ingredient by which the net evolves to produce a more accurate prediction?

11.3 **Car Sales.** Consider the data on used cars (*ToyotaCorolla.csv*) with 1436 records and details on 38 attributes, including Price, Age, KM, HP, and other specifications. The goal is to predict the price of a used Toyota Corolla based on its specifications.

a. Fit a neural network model to the data. Use a single hidden layer with 2 nodes.

• Use predictors Age_08_04, KM, Fuel_Type, HP, Automatic, Doors, Quarterly_Tax, Mfr_Guarantee, Guarantee_Period, Airco, Automatic_airco, CD_Player, Powered_Windows, Sport_Model, and Tow_Bar.

• Remember to first scale the numerical predictor and outcome variables to a 0–1 scale (use function *preprocess()* with *method = "range"*—see Chapter 7) and convert categorical predictors to dummies.

Record the RMS error for the training data and the validation data. Repeat the process, changing the number of hidden layers and nodes to {single layer with 5 nodes}, {two layers, 5 nodes in each layer}.

i. What happens to the RMS error for the training data as the number of layers and nodes increases?

ii. What happens to the RMS error for the validation data?

iii. Comment on the appropriate number of layers and nodes for this application.

11.4 **Direct Mailing to Airline Customers.** East-West Airlines has entered into a partnership with the wireless phone company Telcon to sell the latter's service via direct mail. The file *EastWestAirlinesNN.csv* contains a subset of a data sample of who has already received a test offer. About 13% accepted.