GACAL

1A

$$\Psi_{NN1} = 2V_1 \sin(W_1 X_1 + W_2 X_2^2 + W_3) + 2V_3$$

$$g_1 = \sin(W_1 X_1 + W_2 X_2^2 + W_3)$$

$$h_1 = 2(V_1 g_1 + V_3)$$

$$\Psi_{NN2} = \cos(V_2 \sin(W_1 X_1 + W_2 X_2^2 + W_3))$$

$$h_2 = \cos(V_2 g_1)$$

1B

$$E = \frac{1}{2}\left(\Psi_{NN1} - \Psi_{Th1}\right)^2 + \frac{1}{2}\left(\Psi_{NN2} - \Psi_{th2}\right)^2$$

W1

$$W_1^{t+1} = W_1^t - 0.1 \frac{dE}{dW_1}$$

$$\frac{dE}{dW_1} = \left(\Psi_{NN1} - \Psi_{Th1}\right)\left(2V_1 \cos(W_1 X_1 + W_2 X_2^2 + W_3)\right)(X_1)$$

$$- (\Psi_{NN2} - \Psi_{th2})\left(\sin(V_2 \sin(W_1 X_1 + W_2 X_2^2 + W_3))\right)\left(\cos(V_2 \cos(W_1 X_1 + W_2 X_2^2 + W_3))(X_1)\right)$$

W2

$$W_2^{t+1} = W_2^t - 0.1 \frac{dE}{dW_2}$$

$$\frac{dE}{dW_2} = \left(\Psi_{NN1} - \Psi_{m1}\right)\left(2V_1 \cos(W_1 X_1 + W_2 X_2^2 + W_3)\right)(X_2^2)$$

$$- \left(\Psi_{NN2} - \Psi_{th2}\right)\left(V_2 \sin(V_2 \sin(W_1 X_1 + W_2 X_2^2 + W_3))\right)\left(\cos(W_1 X_1 + W_2 X_2^2 + W_3)\right)(X_2^2)$$

W3

$$W_3^{t+1} = W_3^t - 0.1 \frac{dE}{dW_3}$$

$$\frac{dE}{dW_3} = \left(\Psi_{NN1} - \Psi_{th1}\right) 2V_1 \cos(W_1 X_1 + W_2 X_2^2 + W_3)$$

$$- \left(\Psi_{NN2} - \Psi_{th2}\right) V_2 \sin(V_2 \sin(W_1 X_1 + W_2 X_2^2 + W_3))\left(\cos(W_1 X_1 + W_2 X_2^2 + W_3)\right)$$

V_1

$$V_1^{t+1} = V_1^t - 0.1 \frac{dE}{dV_1}$$

$$\frac{dE}{dV_1} = \left(\Psi_{NN1} - \Psi_{th1}\right)\left(2 \sin\left(w_1 x_1 + w_2 x_2^2 + w_3\right)\right)$$

V_2

$$V_2^{t+1} = V_2^t - 0.1 \frac{dE}{dV_2}$$

$$\frac{dE}{dV_2} = \left(\Psi_{NN2} - \Psi_{th2}\right)\left(-\sin\left(V_2 \sin\left(w_1 x_1 + w_2 x_2^2 + w_3\right)\right)\right)\left(\sin\left(w_1 x_1 + w_2 x_2^2 + w_3\right)\right)$$

V_3

$$V_3^{t+1} = V_3^t - 0.1\left(\frac{dE}{dV_2}\right)$$

$$\frac{dE}{dV_3} = \left(\Psi_{NN1} - \Psi_{th2}\right)(2)$$

(1C) $\quad X_1 = \frac{\pi}{2} \qquad X_2 = 0$

$$\Psi_{NN1} = 2\sin\left(\frac{\pi}{2} + 1\right) + 2 = 3.0806$$

$$\Psi_{NN2} = \cos\left(\sin\left(\frac{\pi}{2} + 1\right)\right) = 0.85755$$