Assignment 5.1.

Given :-

$$w_x = [3, -4] \qquad b_h = 0 \qquad by = 10$$

$$w_h = \begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix} \qquad h_0 = [0, 0]$$

$$x = [1, 2, 3]$$

$$w_y = \begin{bmatrix} -4 \\ 2 \end{bmatrix}$$

No. of RNN units = 2

$$h_t = \tanh(w_x \cdot x_t + w_h \cdot h_{t-1} + b_h)$$

$$h_1 = \tanh(1 \times [3 \quad -4] + 0 + 0)$$

$$= \tanh X = [0.99505 \qquad -0.99932]$$

$$h_2 = \tanh\left(2 \times [3 \quad -4] + [0.99505 \qquad -0.99932] \begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix} + b\right)$$

$$= \tanh\left([6 \quad -8] + [6.97816 \qquad -6.97389]\right)$$

$$= \tanh\left([12.97816 \qquad -14.97389]\right)$$

$$= [0.99999 \qquad -1]$$

$$h_3 = \tanh\left(3 \times [3 \quad -4] + [0.99999 \quad -1]\begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix} + \theta\right)$$

$$= \tanh\left([9 \quad -12] + [6.99996 \quad -6.99995]\right)$$

$$= \tanh\left([15.99996 \quad -18.99995]\right)$$

$$= [1 \quad -1]$$

$$\hat{y}_t = w_y \cdot h_t + b_y$$

$$= w_y \cdot h_3 + b_y$$

$$= [1 \quad -1]\begin{bmatrix} -4 \\ 2 \end{bmatrix} + 10$$

$$= -4 - 2 + 10$$

$$= -6 + 10$$

$$= 4$$

$$\boxed{\hat{y}_t = 4}$$

Assignment 5.2

Ques 10-)

★ Embedding layer.
= vocab length × Required output dim
= 12020 × 6
= 72120

★ Simple RNN layer (first).
= (Recurrent weights) + (no. of units × no. of features from embedding) + (backpropagation).
= (64 × 64) + (64 × 6) + 64.
= 4544.

★ Simple RNN layer (second)
= (Recurrent weights) + (No. of units × no. of units of previous layer) + (backpropagation)
= (32 × 32) + (32 × 64) + 32
= 3104

★ Simple RNN layer (third)
= (16 × 16) + (16 × 32) + 16
= 784

★ Dense layer
= (No. of units × no. of units of previous RNN layer) + (backpropagation)
= (24 × 16) + 24
= 408

☆ Dense (output layer)

= (No. of o/p units × no. of units of previous hidden layer) + (backpropagation)

= (6 × 24) + 6

= 150

Total trainable parameters
= 72120 + 4544 + 3104 + 784 + 408 + 150.
= 81110.