__/__/____

DL Assignment 5

Q1. No. of RNN units = 2

$W_x = \begin{bmatrix} 3 & -4 \end{bmatrix}$ $\quad b_h = 0$

$W_h = \begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix}$ $\quad b_y = 10$

$h_0 = \begin{bmatrix} 0 & 0 \end{bmatrix}$

$W_y = \begin{bmatrix} -4 \\ 2 \end{bmatrix}$ $\quad x_1 = 1 \quad x_2 = 2 \quad x_3 = 3$

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

$$h_1 = \tanh(1 \times \begin{bmatrix} 3 & -4 \end{bmatrix} + 0 + 0)$$

$$= \begin{bmatrix} 0.99505 & -0.99932 \end{bmatrix}$$

$$h_2 = \tanh(2 \times \begin{bmatrix} 3 & -4 \end{bmatrix} + \begin{bmatrix} 0.99505 & -0.99932 \end{bmatrix} \begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix} + 0)$$

$$= \begin{bmatrix} 0.99999 & -1 \end{bmatrix}$$

$$h_3 = \tanh(3 \times \begin{bmatrix} 3 & -4 \end{bmatrix} + \begin{bmatrix} 0.99999 & -1 \end{bmatrix} \begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix} + 0)$$

$$= \begin{bmatrix} 1 & -1 \end{bmatrix}$$

__/__/____

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

$$\hat{y}_t = w_y \cdot h_3 + b_y$$

$$= \begin{bmatrix} 1 & -1 \end{bmatrix} \begin{bmatrix} -4 \\ 2 \end{bmatrix} + 10$$

$$= -6 + 10$$

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

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
embedding (Embedding)        (None, 20, 6)             72120
_________________________________________________________________
simple_rnn (SimpleRNN)       (None, 20, 64)            4544
_________________________________________________________________
simple_rnn_1 (SimpleRNN)     (None, 20, 32)            3104
_________________________________________________________________
simple_rnn_2 (SimpleRNN)     (None, 16)                784
_________________________________________________________________
dropout (Dropout)            (None, 16)                0
_________________________________________________________________
dense (Dense)                (None, 24)                408
_________________________________________________________________
dense_1 (Dense)              (None, 6)                 150
=================================================================
Total params: 81,110
Trainable params: 81,110
Non-trainable params: 0
_________________________________________________________________
```

Q2. I. Embedding → 72120

12020 × 6

(input dim = vocab length) (required output dim.)

II. SimpleRNN (1) → 4544

(64 × 64) + (64 × 6) + 64

(recurrent weights = no of units × no. of units) (no. of units × no. of features from embedding) (biases) backprop.

III. SimpleRNN (2) → 3104

(32 × 32) + (32 × 64) + 32

(recurrent weights) (i/p weights = no. of units × no. of units of previous layer) (backprop.)

IV. SimpleRNN (3) → 784

(16 × 16) + (16 × 32) + 16

(recurrent weights) (i/p weights) (backprop.)

V. Dense → 408

(24 × 16) + 24

(no. of units × no. of units of previous RNN layer.) (backprop)

VI. Dense (output layer) → 150

(6 × 24) + 6

(no. of o/p units × no. of units of previous hidden layer) (backprop.)