

Assignment 00010 FMNIST proof

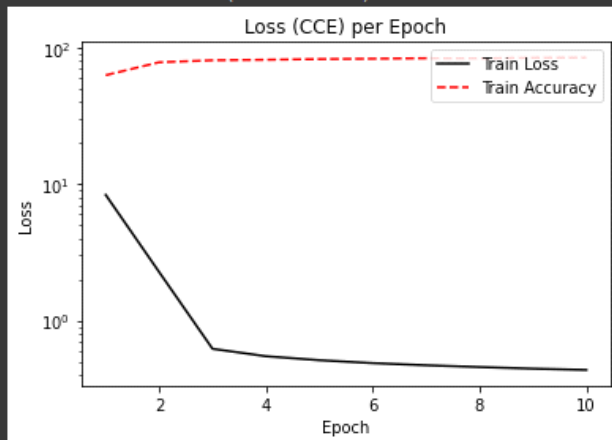
Tuesday, February 8, 2022 8:56 PM

No regularization

SEED 1 # 4340

```
➤ Number of Epoch = 1 - Average Training Loss:= 8.34265  
Training Accuracy = 62.80800104141235  
Number of Epoch = 2 - Average Training Loss:= 2.2698528125  
Training Accuracy = 78.13799977302551  
Number of Epoch = 3 - Average Training Loss:= 0.620897578125  
Training Accuracy = 80.81200122833252  
Number of Epoch = 4 - Average Training Loss:= 0.547571484375  
Training Accuracy = 81.56800270080566  
Number of Epoch = 5 - Average Training Loss:= 0.51220203125  
Training Accuracy = 82.50200152397156  
Number of Epoch = 6 - Average Training Loss:= 0.4874401953125  
Training Accuracy = 83.00999999046326  
Number of Epoch = 7 - Average Training Loss:= 0.470159140625  
Training Accuracy = 83.68800282478333  
Number of Epoch = 8 - Average Training Loss:= 0.45617390625  
Training Accuracy = 83.52599740028381  
Number of Epoch = 9 - Average Training Loss:= 0.4440662109375  
Training Accuracy = 84.38000082969666  
Number of Epoch = 10 - Average Training Loss:= 0.434465859375  
Training Accuracy = 84.52799916267395
```

Total time taken (in seconds): 385.92



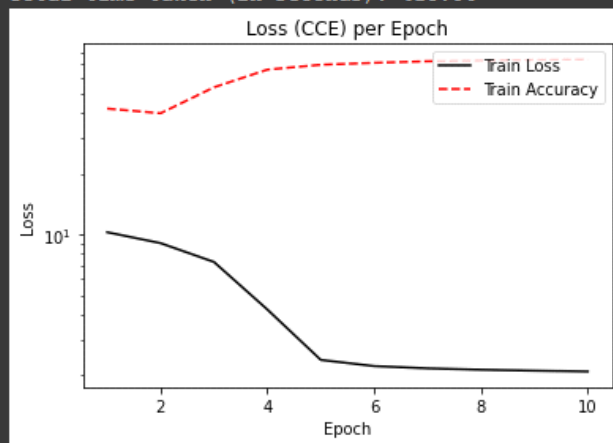
SEED #2 4321

```

Number of Epoch = 1 - Average Training Lost:= 10.23894875
Training Accuracy = 41.958001255989075
Number of Epoch = 2 - Average Training Lost:= 9.03979875
Training Accuracy = 39.78399932384491
Number of Epoch = 3 - Average Training Lost:= 7.291781875
Training Accuracy = 53.501999378204346
Number of Epoch = 4 - Average Training Lost:= 4.2375478125
Training Accuracy = 65.45799970626831
Number of Epoch = 5 - Average Training Lost:= 2.38548015625
Training Accuracy = 69.19400095939636
Number of Epoch = 6 - Average Training Lost:= 2.22305203125
Training Accuracy = 70.72200179100037
Number of Epoch = 7 - Average Training Lost:= 2.1667659375
Training Accuracy = 71.99599742889404
Number of Epoch = 8 - Average Training Lost:= 2.13252265625
Training Accuracy = 72.61999845504761
Number of Epoch = 9 - Average Training Lost:= 2.10946
Training Accuracy = 73.16799759864807
Number of Epoch = 10 - Average Training Lost:= 2.09097671875
Training Accuracy = 73.55999946594238

```

Total time taken (in seconds): 418.36



```

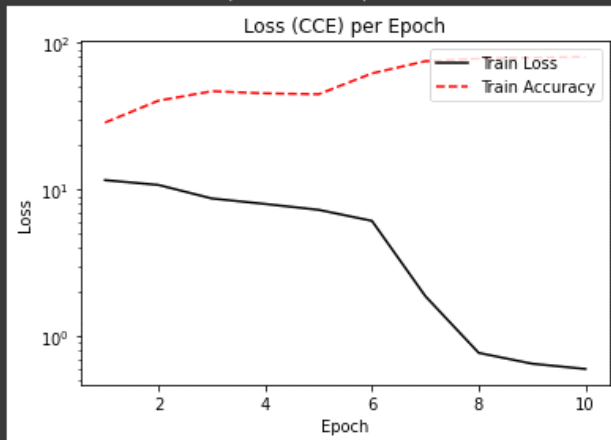
Test CCE: 0.4288
test accuracy = 72.30999755859375

```

SEED#3 3241

```
➤ Number of Epoch = 1 - Average Training Lost:= 11.5861425  
Training Accuracy = 28.617998957633972  
Number of Epoch = 2 - Average Training Lost:= 10.745825  
Training Accuracy = 40.34799933433533  
Number of Epoch = 3 - Average Training Lost:= 8.688848125  
Training Accuracy = 46.80599868297577  
Number of Epoch = 4 - Average Training Lost:= 7.968130625  
Training Accuracy = 45.278000831604004  
Number of Epoch = 5 - Average Training Lost:= 7.27073625  
Training Accuracy = 44.64400112628937  
Number of Epoch = 6 - Average Training Lost:= 6.112695625  
Training Accuracy = 61.93600296974182  
Number of Epoch = 7 - Average Training Lost:= 1.8743359375  
Training Accuracy = 74.98599886894226  
Number of Epoch = 8 - Average Training Lost:= 0.76890296875  
Training Accuracy = 78.08600068092346  
Number of Epoch = 9 - Average Training Lost:= 0.6488321875  
Training Accuracy = 79.49399948120117  
Number of Epoch = 10 - Average Training Lost:= 0.597216015625  
Training Accuracy = 80.30800223350525
```

Total time taken (in seconds): 535.16



```

1 test_loss_total = tf.Variable(0, dtype=tf.float32)
2 correct_test_prediction = tf.Variable(0, dtype=tf.float32)
3 #test_loss_total = 0.0
4
5 for inputs, outputs in test_ds:
6     preds = mlp_on_default.forward(inputs)
7     #b = mlp_on_default.loss(preds, outputs)
8     test_loss_total = test_loss_total + mlp_on_default.loss(preds, outputs)
9
10
11 for i in range(preds.shape[0]):
12     if tf.argmax(preds[i]) == tf.argmax(outputs[i]):
13         correct_test_prediction = correct_test_prediction + 1.0
14
15
16 # a = (test_loss_total.numpy() / X_train.shape[0])
17 # print(X_train.shape[0])
18 # print(test_loss_total.numpy())
19 # print(b)
20 accuracytest = correct_test_prediction/X_test.shape[0]*100
21 print('Test CCE: {:.4f}'.format(np.sum(test_loss_total.numpy()) / X_train.shape[0]))
22 print('test accuracy = {}'.format(accuracytest))
23
24
25

```

```

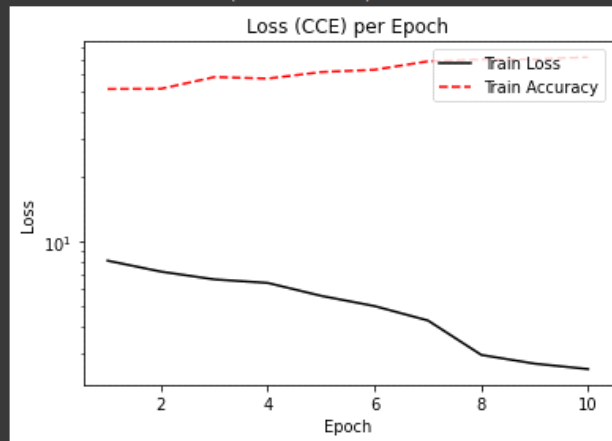
Test CCE: 0.1310
test accuracy = 78.30999755859375

```

SEED 4 1123

Number of Epoch = 1 - Average Training Loss:= 8.154005
Training Accuracy = 51.16199851036072
Number of Epoch = 2 - Average Training Loss:= 7.2506725
Training Accuracy = 51.270002126693726
Number of Epoch = 3 - Average Training Loss:= 6.67304125
Training Accuracy = 58.12399983406067
Number of Epoch = 4 - Average Training Loss:= 6.425709375
Training Accuracy = 57.20599889755249
Number of Epoch = 5 - Average Training Loss:= 5.595988125
Training Accuracy = 61.30800247192383
Number of Epoch = 6 - Average Training Loss:= 5.0161171875
Training Accuracy = 62.84800171852112
Number of Epoch = 7 - Average Training Loss:= 4.2989446875
Training Accuracy = 68.78600120544434
Number of Epoch = 8 - Average Training Loss:= 2.9744003125
Training Accuracy = 70.19799947738647
Number of Epoch = 9 - Average Training Loss:= 2.7095021875
Training Accuracy = 70.3000009059906
Number of Epoch = 10 - Average Training Loss:= 2.5568453125
Training Accuracy = 71.91600203514099

Total time taken (in seconds): 400.41



Test CCE: 0.5218
test accuracy = 70.02999877929688

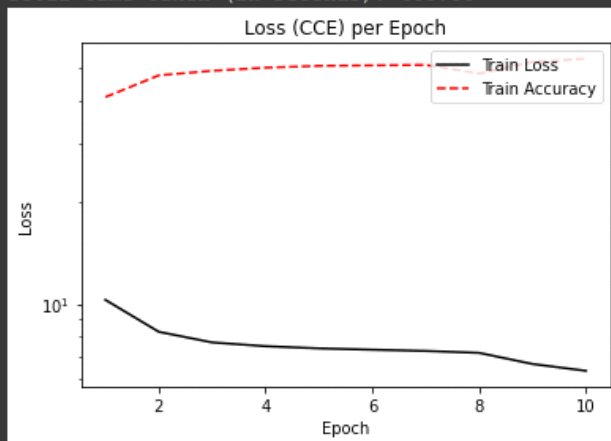
SEED 5 5563

```

Number of Epoch = 1 - Average Training Lost:= 10.29424125
Training Accuracy = 41.07599854469299
Number of Epoch = 2 - Average Training Lost:= 8.276335625
Training Accuracy = 47.65799939632416
Number of Epoch = 3 - Average Training Lost:= 7.69712875
Training Accuracy = 49.160000681877136
Number of Epoch = 4 - Average Training Lost:= 7.501179375
Training Accuracy = 50.227999687194824
Number of Epoch = 5 - Average Training Lost:= 7.391325625
Training Accuracy = 50.83400011062622
Number of Epoch = 6 - Average Training Lost:= 7.3244225
Training Accuracy = 51.02199912071228
Number of Epoch = 7 - Average Training Lost:= 7.262583125
Training Accuracy = 51.169997453689575
Number of Epoch = 8 - Average Training Lost:= 7.16819125
Training Accuracy = 48.24000000953674
Number of Epoch = 9 - Average Training Lost:= 6.643185
Training Accuracy = 52.26200222969055
Number of Epoch = 10 - Average Training Lost:= 6.341676875
Training Accuracy = 53.387999534606934

```

Total time taken (in seconds): 403.85



```

Test CCE: 1.2639
test accuracy = 51.88999938964844

```

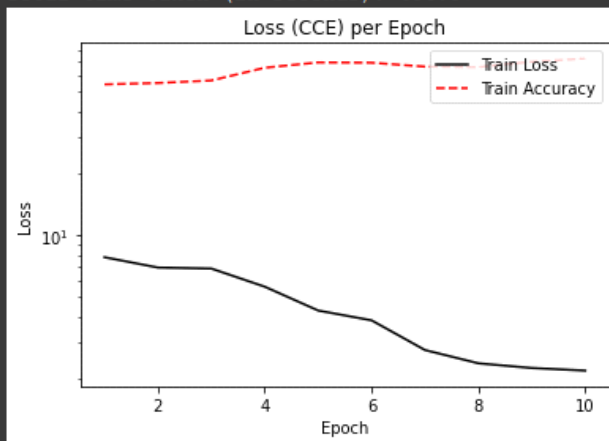
SEED 6

```

Number of Epoch = 1 - Average Training Lost:= 7.8075275
Training Accuracy = 54.339998960494995
Number of Epoch = 2 - Average Training Lost:= 6.953119375
Training Accuracy = 55.1859974861145
Number of Epoch = 3 - Average Training Lost:= 6.875293125
Training Accuracy = 56.74999952316284
Number of Epoch = 4 - Average Training Lost:= 5.60795625
Training Accuracy = 65.49000144004822
Number of Epoch = 5 - Average Training Lost:= 4.2917696875
Training Accuracy = 69.51799988746643
Number of Epoch = 6 - Average Training Lost:= 3.844509375
Training Accuracy = 69.29399967193604
Number of Epoch = 7 - Average Training Lost:= 2.7542578125
Training Accuracy = 66.29999876022339
Number of Epoch = 8 - Average Training Lost:= 2.3733165625
Training Accuracy = 65.93800187110901
Number of Epoch = 9 - Average Training Lost:= 2.25161296875
Training Accuracy = 70.06800174713135
Number of Epoch = 10 - Average Training Lost:= 2.18771
Training Accuracy = 72.61000275611877

```

Total time taken (in seconds): 456.57



```

Test CCE: 0.4545
test accuracy = 70.0999984741211

```

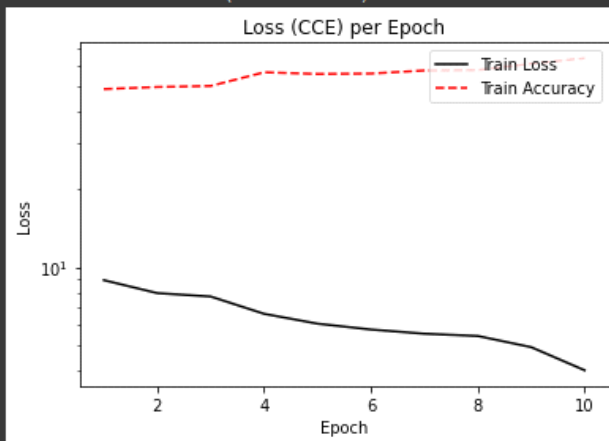
Seed 7

```

Number of Epoch = 1 - Average Training Lost:= 8.931346875
Training Accuracy = 48.57000112533569
Number of Epoch = 2 - Average Training Lost:= 7.962084375
Training Accuracy = 49.483999609947205
Number of Epoch = 3 - Average Training Lost:= 7.725945
Training Accuracy = 49.92400109767914
Number of Epoch = 4 - Average Training Lost:= 6.62777875
Training Accuracy = 56.3679931526184
Number of Epoch = 5 - Average Training Lost:= 6.073205
Training Accuracy = 55.545997619628906
Number of Epoch = 6 - Average Training Lost:= 5.76664125
Training Accuracy = 55.7420015335083
Number of Epoch = 7 - Average Training Lost:= 5.55642375
Training Accuracy = 57.27199912071228
Number of Epoch = 8 - Average Training Lost:= 5.4456475
Training Accuracy = 57.48800039291382
Number of Epoch = 9 - Average Training Lost:= 4.9310525
Training Accuracy = 60.82599759101868
Number of Epoch = 10 - Average Training Lost:= 4.017410625
Training Accuracy = 63.8480007648468

```

Total time taken (in seconds): 406.46



```

Test CCE: 0.8069
test accuracy = 61.75

```

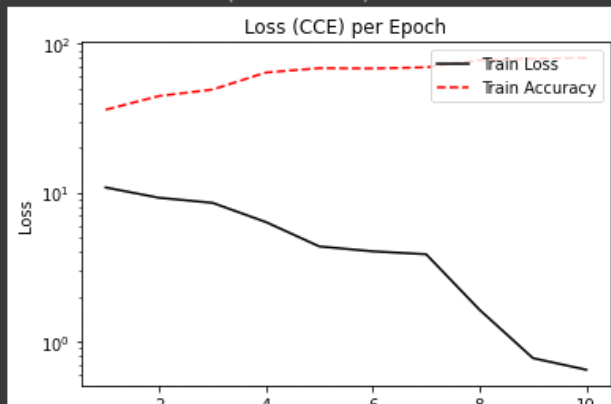
Seed 8


```

Number of Epoch = 1 - Average Training Loss:= 10.82263875
Training Accuracy = 35.96999943256378
Number of Epoch = 2 - Average Training Loss:= 9.2274925
Training Accuracy = 44.47599947452545
Number of Epoch = 3 - Average Training Loss:= 8.53558625
Training Accuracy = 49.09000098705292
Number of Epoch = 4 - Average Training Loss:= 6.34196
Training Accuracy = 63.933998346328735
Number of Epoch = 5 - Average Training Loss:= 4.3510146875
Training Accuracy = 68.35399866104126
Number of Epoch = 6 - Average Training Loss:= 4.0337959375
Training Accuracy = 68.01199913024902
Number of Epoch = 7 - Average Training Loss:= 3.85768
Training Accuracy = 69.22199726104736
Number of Epoch = 8 - Average Training Loss:= 1.63512015625
Training Accuracy = 77.35400199890137
Number of Epoch = 9 - Average Training Loss:= 0.77443828125
Training Accuracy = 79.10199761390686
Number of Epoch = 10 - Average Training Loss:= 0.647173359375
Training Accuracy = 80.28600215911865

```

Total time taken (in seconds): 505.21



```

Test CCE: 0.1333
test accuracy = 78.97999572753906

```

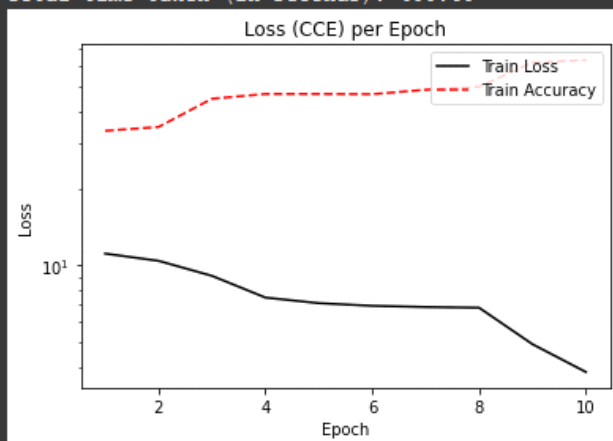
Seed 9

```

X Number of Epoch = 1 - Average Training Lost:= 11.11230125
  Training Accuracy = 33.56600105762482
  Number of Epoch = 2 - Average Training Lost:= 10.410150625
  Training Accuracy = 34.75598849868774
  Number of Epoch = 3 - Average Training Lost:= 9.09297625
  Training Accuracy = 44.811999797821045
  Number of Epoch = 4 - Average Training Lost:= 7.477495
  Training Accuracy = 46.76600098609924
  Number of Epoch = 5 - Average Training Lost:= 7.110350625
  Training Accuracy = 46.75799906253815
  Number of Epoch = 6 - Average Training Lost:= 6.942915625
  Training Accuracy = 46.67600095272064
  Number of Epoch = 7 - Average Training Lost:= 6.868624375
  Training Accuracy = 48.58799874782562
  Number of Epoch = 8 - Average Training Lost:= 6.825575
  Training Accuracy = 49.917998909950256
  Number of Epoch = 9 - Average Training Lost:= 4.91367625
  Training Accuracy = 62.05199956893921
  Number of Epoch = 10 - Average Training Lost:= 3.8258765625
  Training Accuracy = 63.49800229072571

```

Total time taken (in seconds): 400.60



```

Test CCE: 0.7688
test accuracy = 61.66999816894531

```

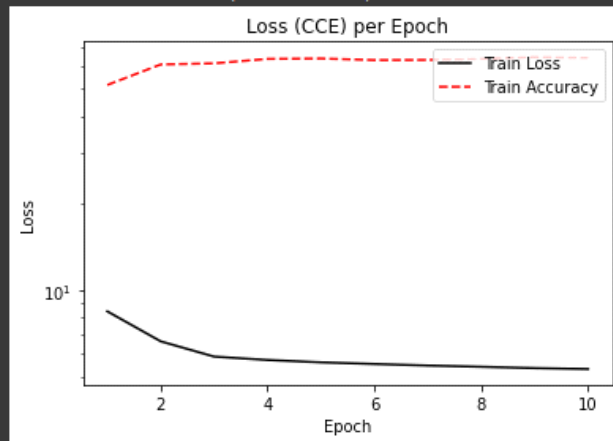
Seed 10

```

Number of Epoch = 1 - Average Training Loss:= 8.422856875
Training Accuracy = 51.555997133255005
Number of Epoch = 2 - Average Training Loss:= 6.625089375
Training Accuracy = 60.76200008392334
Number of Epoch = 3 - Average Training Loss:= 5.86354125
Training Accuracy = 61.29999756813049
Number of Epoch = 4 - Average Training Loss:= 5.70761625
Training Accuracy = 63.51799964904785
Number of Epoch = 5 - Average Training Loss:= 5.60033625
Training Accuracy = 63.73000144958496
Number of Epoch = 6 - Average Training Loss:= 5.5276625
Training Accuracy = 62.922000885009766
Number of Epoch = 7 - Average Training Loss:= 5.458885625
Training Accuracy = 62.998002767562866
Number of Epoch = 8 - Average Training Loss:= 5.40539875
Training Accuracy = 63.52199912071228
Number of Epoch = 9 - Average Training Loss:= 5.346696875
Training Accuracy = 64.4320011138916
Number of Epoch = 10 - Average Training Loss:= 5.308783125
Training Accuracy = 64.04200196266174

```

Total time taken (in seconds): 411.83



```

Test CCE: 1.0920
test accuracy = 63.090003967285156

```

L2 Regularization default

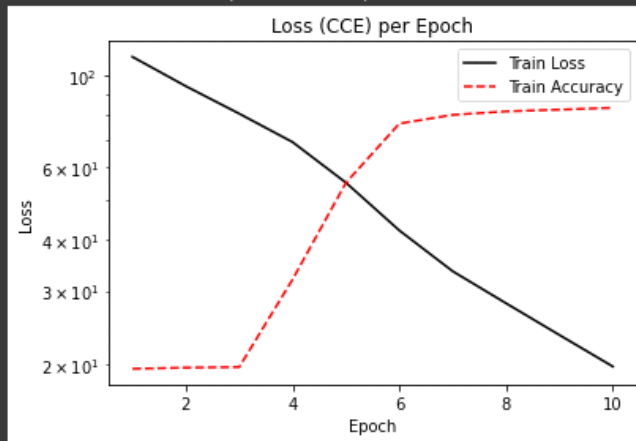
SEED1

```

Number of Epoch = 1 - Average Training Lost:= 111.00263
Training Accuracy = 19.453999400138855
Number of Epoch = 2 - Average Training Lost:= 94.23659
Training Accuracy = 19.580000638961792
Number of Epoch = 3 - Average Training Lost:= 80.83821
Training Accuracy = 19.64399963617325
Number of Epoch = 4 - Average Training Lost:= 68.96149
Training Accuracy = 32.03800022602081
Number of Epoch = 5 - Average Training Lost:= 54.97311
Training Accuracy = 54.979997873306274
Number of Epoch = 6 - Average Training Lost:= 42.11331
Training Accuracy = 76.49000287055969
Number of Epoch = 7 - Average Training Lost:= 33.528475
Training Accuracy = 80.28600215911865
Number of Epoch = 8 - Average Training Lost:= 28.03688
Training Accuracy = 81.86799883842468
Number of Epoch = 9 - Average Training Lost:= 23.4881825
Training Accuracy = 82.66800045967102
Number of Epoch = 10 - Average Training Lost:= 19.701925
Training Accuracy = 83.53999853134155

```

Total time taken (in seconds): 613.20



```

Test CCE: 3.6121
test accuracy = 82.30999755859375

```

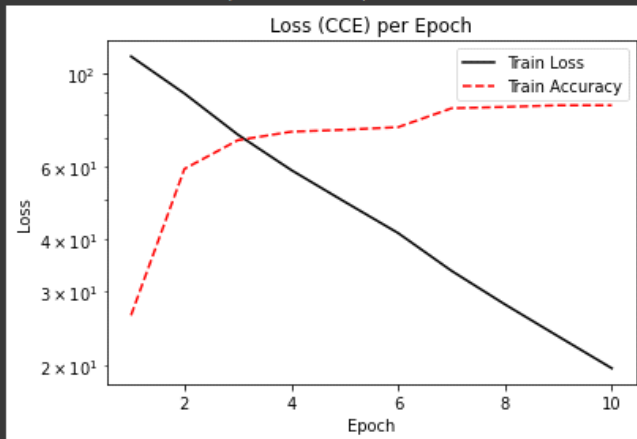
SEED 2

```

Number of Epoch = 1 - Average Training Loss:= 109.94166
Training Accuracy = 26.350000500679016
Number of Epoch = 2 - Average Training Loss:= 89.57912
Training Accuracy = 59.11599937057495
Number of Epoch = 3 - Average Training Loss:= 71.397225
Training Accuracy = 69.23999786376953
Number of Epoch = 4 - Average Training Loss:= 58.720285
Training Accuracy = 72.57199883460999
Number of Epoch = 5 - Average Training Loss:= 49.294145
Training Accuracy = 73.34399819374084
Number of Epoch = 6 - Average Training Loss:= 41.4814075
Training Accuracy = 74.40999746322632
Number of Epoch = 7 - Average Training Loss:= 33.6800925
Training Accuracy = 82.58399963378906
Number of Epoch = 8 - Average Training Loss:= 27.985045
Training Accuracy = 83.19200277328491
Number of Epoch = 9 - Average Training Loss:= 23.45208
Training Accuracy = 83.94200205802917
Number of Epoch = 10 - Average Training Loss:= 19.67477125
Training Accuracy = 83.9460015296936

```

Total time taken (in seconds): 714.26



```

Test CCE: 3.6089
test accuracy = 82.56000518798828

```

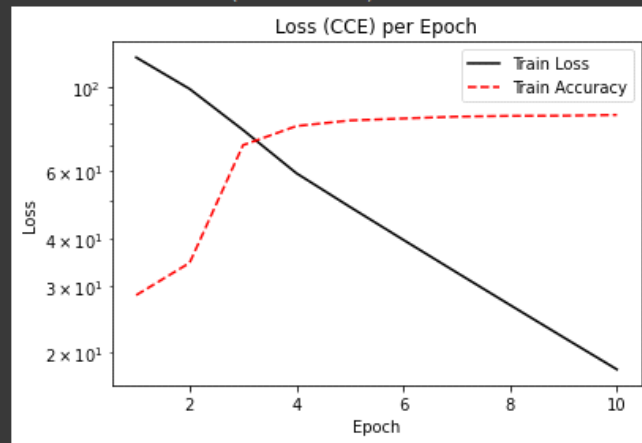
SEED 3

```

Number of Epoch = 1 - Average Training Lost:= 119.42071
Training Accuracy = 28.341999650001526
Number of Epoch = 2 - Average Training Lost:= 98.68924
Training Accuracy = 34.450000524520874
Number of Epoch = 3 - Average Training Lost:= 76.9887
Training Accuracy = 70.2459990978241
Number of Epoch = 4 - Average Training Lost:= 59.25693
Training Accuracy = 78.83399724960327
Number of Epoch = 5 - Average Training Lost:= 48.35339
Training Accuracy = 81.55199885368347
Number of Epoch = 6 - Average Training Lost:= 39.6125025
Training Accuracy = 82.52999782562256
Number of Epoch = 7 - Average Training Lost:= 32.500265
Training Accuracy = 83.4559977054596
Number of Epoch = 8 - Average Training Lost:= 26.696195
Training Accuracy = 83.83200168609619
Number of Epoch = 9 - Average Training Lost:= 21.95446
Training Accuracy = 83.92599821090698
Number of Epoch = 10 - Average Training Lost:= 18.07870375
Training Accuracy = 84.34600234031677

```

Total time taken (in seconds): 597.82



```

Test CCE: 3.2856
test accuracy = 82.70999908447266

```

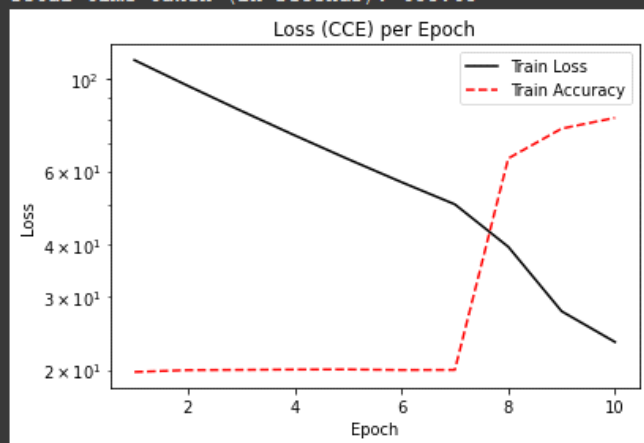
SEED 4

```

Number of Epoch = 1 - Average Training Lost:= 111.02621
Training Accuracy = 19.765999913215637
Number of Epoch = 2 - Average Training Lost:= 96.32078
Training Accuracy = 19.971999526023865
Number of Epoch = 3 - Average Training Lost:= 83.835125
Training Accuracy = 19.99800056219101
Number of Epoch = 4 - Average Training Lost:= 73.218565
Training Accuracy = 20.034000277519226
Number of Epoch = 5 - Average Training Lost:= 64.191025
Training Accuracy = 20.04600018262863
Number of Epoch = 6 - Average Training Lost:= 56.513765
Training Accuracy = 19.981999695301056
Number of Epoch = 7 - Average Training Lost:= 49.98548
Training Accuracy = 19.995999336242676
Number of Epoch = 8 - Average Training Lost:= 39.525225
Training Accuracy = 64.437997341156
Number of Epoch = 9 - Average Training Lost:= 27.6550875
Training Accuracy = 76.00600123405457
Number of Epoch = 10 - Average Training Lost:= 23.3255575
Training Accuracy = 80.68000078201294

```

Total time taken (in seconds): 638.68



```

Test CCE: 4.3121
test accuracy = 79.0

```

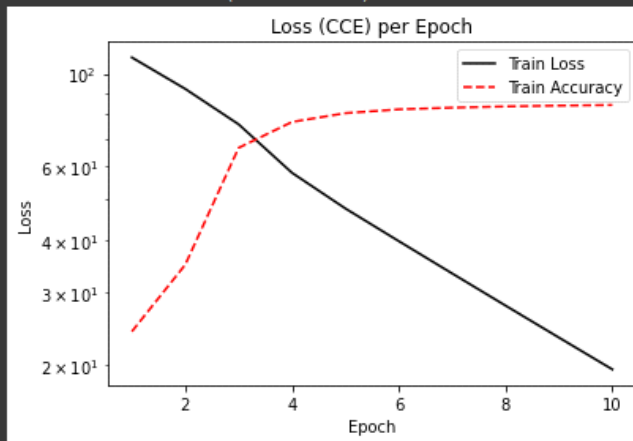
SEED 5

```

Number of Epoch = 1 - Average Training Lost:= 109.55375
Training Accuracy = 24.1239994764328
Number of Epoch = 2 - Average Training Lost:= 92.10074
Training Accuracy = 34.894001483917236
Number of Epoch = 3 - Average Training Lost:= 75.73414
Training Accuracy = 66.52200222015381
Number of Epoch = 4 - Average Training Lost:= 57.943655
Training Accuracy = 76.73799991607666
Number of Epoch = 5 - Average Training Lost:= 47.58628
Training Accuracy = 80.55199980735779
Number of Epoch = 6 - Average Training Lost:= 39.738475
Training Accuracy = 82.26199746131897
Number of Epoch = 7 - Average Training Lost:= 33.2432575
Training Accuracy = 83.0340027809143
Number of Epoch = 8 - Average Training Lost:= 27.8393825
Training Accuracy = 83.59000086784363
Number of Epoch = 9 - Average Training Lost:= 23.3339075
Training Accuracy = 83.97200107574463
Number of Epoch = 10 - Average Training Lost:= 19.57754625
Training Accuracy = 84.27000045776367

```

Total time taken (in seconds): 612.28



Validation

```

Test CCE: 3.5907
test accuracy = 83.27000427246094

```

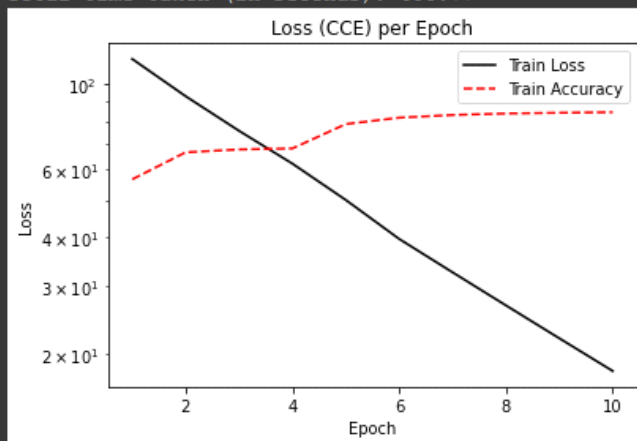
SEED 6


```

Number of Epoch = 1 - Average Training Lost:= 115.72882
Training Accuracy = 56.53600096702576
Number of Epoch = 2 - Average Training Lost:= 92.72793
Training Accuracy = 66.40599966049194
Number of Epoch = 3 - Average Training Lost:= 75.47275
Training Accuracy = 67.54800081253052
Number of Epoch = 4 - Average Training Lost:= 62.07945
Training Accuracy = 67.95399785041809
Number of Epoch = 5 - Average Training Lost:= 50.004025
Training Accuracy = 78.54200005531311
Number of Epoch = 6 - Average Training Lost:= 39.656455
Training Accuracy = 81.5999984741211
Number of Epoch = 7 - Average Training Lost:= 32.5137525
Training Accuracy = 82.9200029373169
Number of Epoch = 8 - Average Training Lost:= 26.6992725
Training Accuracy = 83.64400267601013
Number of Epoch = 9 - Average Training Lost:= 21.9508125
Training Accuracy = 84.02199745178223
Number of Epoch = 10 - Average Training Lost:= 18.070205
Training Accuracy = 84.29200053215027

```

Total time taken (in seconds): 603.77



```

Test CCE: 3.2833
test accuracy = 82.99000549316406

```

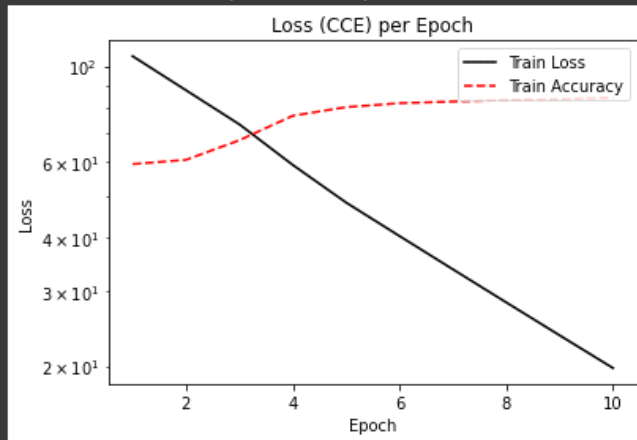
SEED 7

```

Number of Epoch = 1 - Average Training Lost:= 105.56119
Training Accuracy = 59.15399789810181
Number of Epoch = 2 - Average Training Lost:= 87.92445
Training Accuracy = 60.52600145339966
Number of Epoch = 3 - Average Training Lost:= 73.2126
Training Accuracy = 67.23600029945374
Number of Epoch = 4 - Average Training Lost:= 58.89997
Training Accuracy = 76.67199969291687
Number of Epoch = 5 - Average Training Lost:= 48.130805
Training Accuracy = 80.29400110244751
Number of Epoch = 6 - Average Training Lost:= 40.21135
Training Accuracy = 82.01799988746643
Number of Epoch = 7 - Average Training Lost:= 33.6421
Training Accuracy = 82.7459990978241
Number of Epoch = 8 - Average Training Lost:= 28.169795
Training Accuracy = 83.48199725151062
Number of Epoch = 9 - Average Training Lost:= 23.60801
Training Accuracy = 83.85999798774719
Number of Epoch = 10 - Average Training Lost:= 19.803455
Training Accuracy = 84.42000150680542

```

Total time taken (in seconds): 761.94



```

Test CCE: 3.6329
test accuracy = 83.09000396728516

```

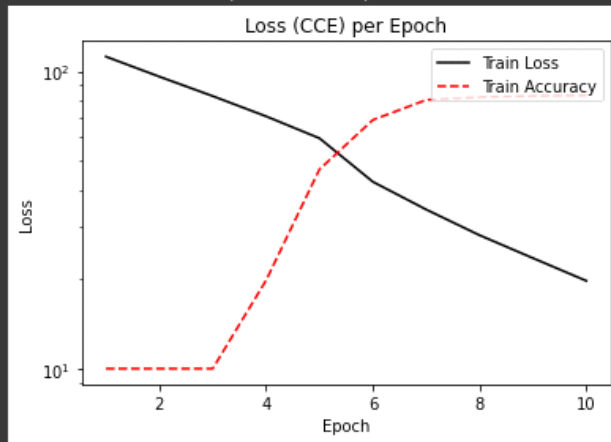
SEED 8

```

Number of Epoch = 1 - Average Training Lost:= 112.08205
Training Accuracy = 10.007999837398529
Number of Epoch = 2 - Average Training Lost:= 96.00524
Training Accuracy = 10.007999837398529
Number of Epoch = 3 - Average Training Lost:= 82.579555
Training Accuracy = 10.007999837398529
Number of Epoch = 4 - Average Training Lost:= 70.602195
Training Accuracy = 19.82399970293045
Number of Epoch = 5 - Average Training Lost:= 59.564195
Training Accuracy = 46.84000015258789
Number of Epoch = 6 - Average Training Lost:= 42.51976
Training Accuracy = 68.64799857139587
Number of Epoch = 7 - Average Training Lost:= 34.296805
Training Accuracy = 80.15599846839905
Number of Epoch = 8 - Average Training Lost:= 28.1067975
Training Accuracy = 81.90199732780457
Number of Epoch = 9 - Average Training Lost:= 23.54034
Training Accuracy = 82.75200128555298
Number of Epoch = 10 - Average Training Lost:= 19.74436625
Training Accuracy = 82.9859972000122

```

Total time taken (in seconds): 639.14



```

Test CCE: 3.6223
test accuracy = 81.77999877929688

```

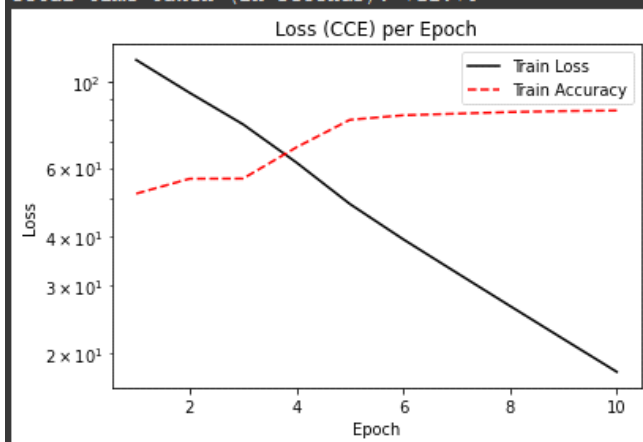
SEED 9

```

Number of Epoch = 2 - Average Training Loss:= 93.54976
Training Accuracy = 56.25799894332886
Number of Epoch = 3 - Average Training Loss:= 77.629045
Training Accuracy = 56.30599856376648
Number of Epoch = 4 - Average Training Loss:= 61.934655
Training Accuracy = 67.75000095367432
Number of Epoch = 5 - Average Training Loss:= 48.4645
Training Accuracy = 79.72599864006042
Number of Epoch = 6 - Average Training Loss:= 39.3209325
Training Accuracy = 81.90000057220459
Number of Epoch = 7 - Average Training Loss:= 32.259
Training Accuracy = 82.68399834632874
Number of Epoch = 8 - Average Training Loss:= 26.49845
Training Accuracy = 83.46400260925293
Number of Epoch = 9 - Average Training Loss:= 21.7919075
Training Accuracy = 83.96599888801575
Number of Epoch = 10 - Average Training Loss:= 17.943185
Training Accuracy = 84.21800136566162

```

Total time taken (in seconds): 712.70



```

Test CCE: 3.2594
test accuracy = 82.70000457763672

```

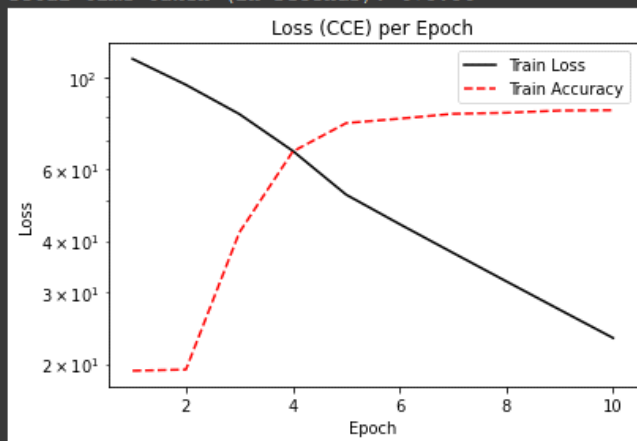
SEED 10

```

Number of Epoch = 1 - Average Training Lost:= 111.24311
Training Accuracy = 19.26800012588501
Number of Epoch = 2 - Average Training Lost:= 96.16453
Training Accuracy = 19.39599961042404
Number of Epoch = 3 - Average Training Lost:= 81.57322
Training Accuracy = 41.929998993873596
Number of Epoch = 4 - Average Training Lost:= 66.324455
Training Accuracy = 66.07800126075745
Number of Epoch = 5 - Average Training Lost:= 51.856325
Training Accuracy = 77.53599882125854
Number of Epoch = 6 - Average Training Lost:= 43.94863
Training Accuracy = 79.4920027256012
Number of Epoch = 7 - Average Training Lost:= 37.3891275
Training Accuracy = 81.69400095939636
Number of Epoch = 8 - Average Training Lost:= 31.84605
Training Accuracy = 82.17200040817261
Number of Epoch = 9 - Average Training Lost:= 27.148805
Training Accuracy = 83.19200277328491
Number of Epoch = 10 - Average Training Lost:= 23.1626075
Training Accuracy = 83.3840012550354

```

Total time taken (in seconds): 673.36



```

Test CCE: 4.2854
test accuracy = 81.72000122070312

```

L1L2

SEED1

```
Number of Epoch = 1 - Average Training Lost:= 10.307469375
Training Accuracy = 37.7020001411438
Number of Epoch = 2 - Average Training Lost:= 9.748576875
Training Accuracy = 42.57799983024597
Number of Epoch = 3 - Average Training Lost:= 8.048935
Training Accuracy = 53.68000268936157
Number of Epoch = 4 - Average Training Lost:= 7.12032625
Training Accuracy = 55.229997634887695
Number of Epoch = 5 - Average Training Lost:= 5.9475825
Training Accuracy = 71.61800265312195
Number of Epoch = 6 - Average Training Lost:= 0.74750375
Training Accuracy = 79.54999804496765
Number of Epoch = 7 - Average Training Lost:= 0.5806192578125
Training Accuracy = 81.24600052833557
Number of Epoch = 8 - Average Training Lost:= 0.5310640625
Training Accuracy = 82.27800130844116
Number of Epoch = 9 - Average Training Lost:= 0.5040592578125
Training Accuracy = 82.9580008983612
Number of Epoch = 10 - Average Training Lost:= 0.4828416796875
Training Accuracy = 83.30600261688232
Number of Epoch = 11 - Average Training Lost:= 0.4667969140625
Training Accuracy = 83.77799987792969
Number of Epoch = 12 - Average Training Lost:= 0.4547828125
Training Accuracy = 83.8919997215271
Number of Epoch = 13 - Average Training Lost:= 0.445338515625
Training Accuracy = 84.28599834442139
Number of Epoch = 14 - Average Training Lost:= 0.4353863671875
Training Accuracy = 84.29999947547913
Number of Epoch = 15 - Average Training Lost:= 0.4269913671875
Training Accuracy = 84.18800234794617

Total time taken (in seconds): 785.52
```

```
Test CCE: 0.1028
test accuracy = 82.1300048828125
```

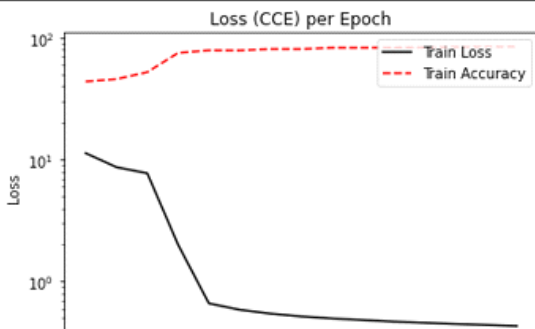
SEED 2

```

Number of Epoch = 1 - Average Training Lost:= 11.28818625
Training Accuracy = 43.630000948905945
Number of Epoch = 2 - Average Training Lost:= 8.660139375
Training Accuracy = 45.63800096511841
Number of Epoch = 3 - Average Training Lost:= 7.7226125
Training Accuracy = 52.07599997520447
Number of Epoch = 4 - Average Training Lost:= 2.00807515625
Training Accuracy = 74.84999895095825
Number of Epoch = 5 - Average Training Lost:= 0.66271
Training Accuracy = 78.58200073242188
Number of Epoch = 6 - Average Training Lost:= 0.5869012109375
Training Accuracy = 78.42199802398682
Number of Epoch = 7 - Average Training Lost:= 0.5457381640625
Training Accuracy = 80.60799837112427
Number of Epoch = 8 - Average Training Lost:= 0.5180058203125
Training Accuracy = 80.52999973297119
Number of Epoch = 9 - Average Training Lost:= 0.49822453125
Training Accuracy = 82.56000280380249
Number of Epoch = 10 - Average Training Lost:= 0.48380109375
Training Accuracy = 82.53399729728699
Number of Epoch = 11 - Average Training Lost:= 0.4691906640625
Training Accuracy = 82.81199932098389
Number of Epoch = 12 - Average Training Lost:= 0.458966015625
Training Accuracy = 83.17000269889832
Number of Epoch = 13 - Average Training Lost:= 0.448753046875
Training Accuracy = 83.74800086021423
Number of Epoch = 14 - Average Training Lost:= 0.4409262890625
Training Accuracy = 83.98000001907349
Number of Epoch = 15 - Average Training Lost:= 0.43217921875
Training Accuracy = 84.29999947547913

```

Total time taken (in seconds): 828.78



```

Test CCE: 0.1013
test accuracy = 82.18000030517578

```

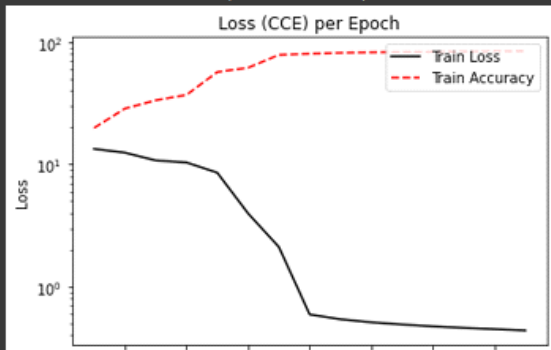
SEED 3

```

Number of Epoch = 1 - Average Training Lost:= 13.3432175
Training Accuracy = 19.784000515937805
Number of Epoch = 2 - Average Training Lost:= 12.4305875
Training Accuracy = 28.49000096321106
Number of Epoch = 3 - Average Training Lost:= 10.748705
Training Accuracy = 33.32799971103668
Number of Epoch = 4 - Average Training Lost:= 10.332931875
Training Accuracy = 36.84400022029877
Number of Epoch = 5 - Average Training Lost:= 8.53494625
Training Accuracy = 56.72000050544739
Number of Epoch = 6 - Average Training Lost:= 3.9628884375
Training Accuracy = 61.49799823760986
Number of Epoch = 7 - Average Training Lost:= 2.1072409375
Training Accuracy = 78.33999991416931
Number of Epoch = 8 - Average Training Lost:= 0.5905523828125
Training Accuracy = 80.0279974937439
Number of Epoch = 9 - Average Training Lost:= 0.5401274609375
Training Accuracy = 81.49799704551697
Number of Epoch = 10 - Average Training Lost:= 0.5099429296875
Training Accuracy = 82.20599889755249
Number of Epoch = 11 - Average Training Lost:= 0.4892179296875
Training Accuracy = 82.89999961853027
Number of Epoch = 12 - Average Training Lost:= 0.4719447265625
Training Accuracy = 83.08200240135193
Number of Epoch = 13 - Average Training Lost:= 0.4587978125
Training Accuracy = 83.433997631073
Number of Epoch = 14 - Average Training Lost:= 0.4481543359375
Training Accuracy = 83.71800184249878
Number of Epoch = 15 - Average Training Lost:= 0.4374480078125
Training Accuracy = 84.20000076293945

```

Total time taken (in seconds): 689.38



```

Test CCE: 3.6223
test accuracy = 81.77999877929688

```

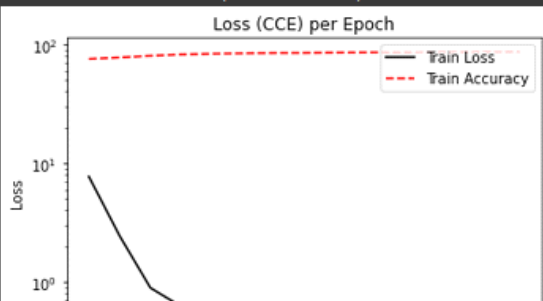
SEED 4


```

C> Number of Epoch = 1 - Average Training Lost:= 7.690538125
    Training Accuracy = 75.0980019569397
    Number of Epoch = 2 - Average Training Lost:= 2.43258890625
    Training Accuracy = 77.22799777984619
    Number of Epoch = 3 - Average Training Lost:= 0.8877575
    Training Accuracy = 79.86000180244446
    Number of Epoch = 4 - Average Training Lost:= 0.617796171875
    Training Accuracy = 81.94199800491333
    Number of Epoch = 5 - Average Training Lost:= 0.530441484375
    Training Accuracy = 83.1499993801117
    Number of Epoch = 6 - Average Training Lost:= 0.4898398828125
    Training Accuracy = 83.78599882125854
    Number of Epoch = 7 - Average Training Lost:= 0.4655023046875
    Training Accuracy = 84.34200286865234
    Number of Epoch = 8 - Average Training Lost:= 0.4478446875
    Training Accuracy = 84.5579981803894
    Number of Epoch = 9 - Average Training Lost:= 0.435011875
    Training Accuracy = 85.11199951171875
    Number of Epoch = 10 - Average Training Lost:= 0.4227468359375
    Training Accuracy = 85.36999821662903
    Number of Epoch = 11 - Average Training Lost:= 0.413381328125
    Training Accuracy = 85.51200032234192
    Number of Epoch = 12 - Average Training Lost:= 0.404821796875
    Training Accuracy = 85.70200204849243
    Number of Epoch = 13 - Average Training Lost:= 0.39726671875
    Training Accuracy = 85.88600158691406
    Number of Epoch = 14 - Average Training Lost:= 0.3902178515625
    Training Accuracy = 86.15599870681763
    Number of Epoch = 15 - Average Training Lost:= 0.3835926953125
    Training Accuracy = 86.31399869918823

```

Total time taken (in seconds): 1032.87



```

C> Test CCE: 0.1028
    test accuracy = 82.1300048828125

```

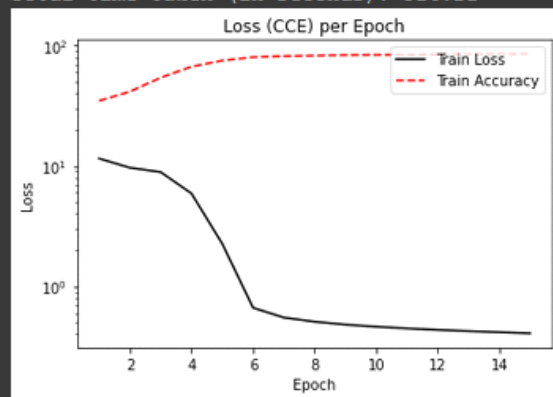
SEED 5

```

Number of Epoch = 1 - Average Training Lost:= 11.5385475
Training Accuracy = 34.78200137615204
Number of Epoch = 2 - Average Training Lost:= 9.6665175
Training Accuracy = 41.50800108909607
Number of Epoch = 3 - Average Training Lost:= 8.89999875
Training Accuracy = 54.228001832962036
Number of Epoch = 4 - Average Training Lost:= 5.909945625
Training Accuracy = 66.88799858093262
Number of Epoch = 5 - Average Training Lost:= 2.25747875
Training Accuracy = 75.18600225448608
Number of Epoch = 6 - Average Training Lost:= 0.66279859375
Training Accuracy = 80.24600148200989
Number of Epoch = 7 - Average Training Lost:= 0.54904359375
Training Accuracy = 81.90199732780457
Number of Epoch = 8 - Average Training Lost:= 0.50740703125
Training Accuracy = 82.66000151634216
Number of Epoch = 9 - Average Training Lost:= 0.4802787109375
Training Accuracy = 83.53400230407715
Number of Epoch = 10 - Average Training Lost:= 0.4610845703125
Training Accuracy = 83.80799889564514
Number of Epoch = 11 - Average Training Lost:= 0.44624828125
Training Accuracy = 84.10800099372864
Number of Epoch = 12 - Average Training Lost:= 0.4337169140625
Training Accuracy = 84.6119998855591
Number of Epoch = 13 - Average Training Lost:= 0.4234611328125
Training Accuracy = 84.90800261497498
Number of Epoch = 14 - Average Training Lost:= 0.41511546875
Training Accuracy = 85.32599806785583
Number of Epoch = 15 - Average Training Lost:= 0.406215
Training Accuracy = 85.53400039672852

```

Total time taken (in seconds): 916.21



```

Test CCE: 0.0982
test accuracy = 83.04000091552734

```

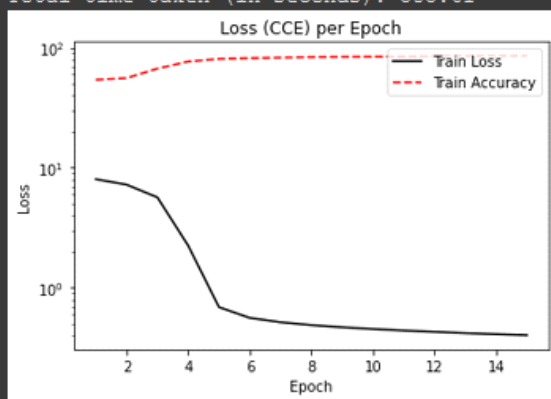
SEED 6

```

Training Accuracy = 54.09799814224243
Number of Epoch = 2 - Average Training Loss:= 7.224408125
Training Accuracy = 55.81200122833252
Number of Epoch = 3 - Average Training Loss:= 5.661769375
Training Accuracy = 66.94999933242798
Number of Epoch = 4 - Average Training Loss:= 2.24265171875
Training Accuracy = 76.6979992389679
Number of Epoch = 5 - Average Training Loss:= 0.6888528125
Training Accuracy = 80.65199851989746
Number of Epoch = 6 - Average Training Loss:= 0.560247265625
Training Accuracy = 81.8660020828247
Number of Epoch = 7 - Average Training Loss:= 0.51565328125
Training Accuracy = 82.71600008010864
Number of Epoch = 8 - Average Training Loss:= 0.488139921875
Training Accuracy = 83.52199792861938
Number of Epoch = 9 - Average Training Loss:= 0.4680346875
Training Accuracy = 83.95000100135803
Number of Epoch = 10 - Average Training Loss:= 0.4527621484375
Training Accuracy = 84.23399925231934
Number of Epoch = 11 - Average Training Loss:= 0.439637421875
Training Accuracy = 84.49199795722961
Number of Epoch = 12 - Average Training Loss:= 0.4287473046875
Training Accuracy = 84.98600125312805
Number of Epoch = 13 - Average Training Loss:= 0.4182266015625
Training Accuracy = 85.40199995040894
Number of Epoch = 14 - Average Training Loss:= 0.410005078125
Training Accuracy = 85.54800152778625
Number of Epoch = 15 - Average Training Loss:= 0.402410859375
Training Accuracy = 85.61599850654602

```

Total time taken (in seconds): 585.61



```

Test CCE: 0.1028
test accuracy = 82.1300048828125

```

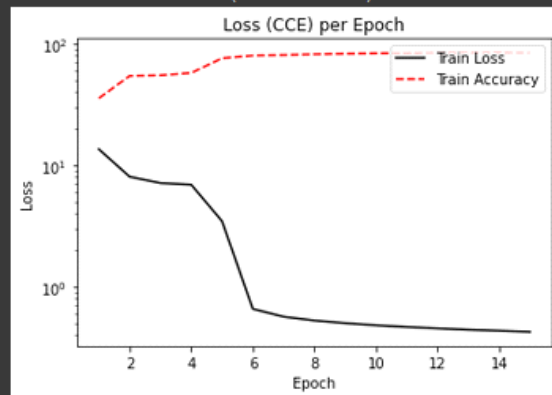
SEED 7

```

Number of Epoch = 1 - Average Training Loss:= 13.50200875
Training Accuracy = 35.401999950408936
Number of Epoch = 2 - Average Training Loss:= 8.018645
Training Accuracy = 54.096001386642456
Number of Epoch = 3 - Average Training Loss:= 7.11338875
Training Accuracy = 54.71000075340271
Number of Epoch = 4 - Average Training Loss:= 6.899576875
Training Accuracy = 57.20999836921692
Number of Epoch = 5 - Average Training Loss:= 3.458350625
Training Accuracy = 75.51199793815613
Number of Epoch = 6 - Average Training Loss:= 0.656868359375
Training Accuracy = 79.47199940681458
Number of Epoch = 7 - Average Training Loss:= 0.56630796875
Training Accuracy = 80.27600049972534
Number of Epoch = 8 - Average Training Loss:= 0.526931640625
Training Accuracy = 81.47000074386597
Number of Epoch = 9 - Average Training Loss:= 0.501364140625
Training Accuracy = 82.2920024394989
Number of Epoch = 10 - Average Training Loss:= 0.4813461328125
Training Accuracy = 83.09800028800964
Number of Epoch = 11 - Average Training Loss:= 0.466467578125
Training Accuracy = 83.32599997520447
Number of Epoch = 12 - Average Training Loss:= 0.454025078125
Training Accuracy = 83.91199707984924
Number of Epoch = 13 - Average Training Loss:= 0.44273703125
Training Accuracy = 84.0399980545044
Number of Epoch = 14 - Average Training Loss:= 0.4344128515625
Training Accuracy = 84.1920018196106
Number of Epoch = 15 - Average Training Loss:= 0.4253426953125
Training Accuracy = 83.80600214004517

```

Total time taken (in seconds): 704.07



```

Test CCE: 3.6329
test accuracy = 83.09000396728516

```

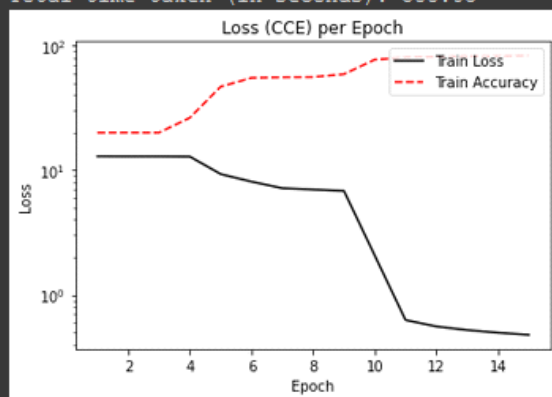
sEEd 8

```

Number of Epoch = 1 - Average Training Lost:= 12.917705
Training Accuracy = 19.995999336242676
Number of Epoch = 2 - Average Training Lost:= 12.89386625
Training Accuracy = 20.024000108242035
Number of Epoch = 3 - Average Training Lost:= 12.891055
Training Accuracy = 20.0080007314682
Number of Epoch = 4 - Average Training Lost:= 12.8482125
Training Accuracy = 26.32400095462799
Number of Epoch = 5 - Average Training Lost:= 9.29784375
Training Accuracy = 46.75399959087372
Number of Epoch = 6 - Average Training Lost:= 8.0824125
Training Accuracy = 55.08999824523926
Number of Epoch = 7 - Average Training Lost:= 7.161465625
Training Accuracy = 55.69000244140625
Number of Epoch = 8 - Average Training Lost:= 6.9909925
Training Accuracy = 55.86199760437012
Number of Epoch = 9 - Average Training Lost:= 6.8191175
Training Accuracy = 58.91000032424927
Number of Epoch = 10 - Average Training Lost:= 2.0656496875
Training Accuracy = 77.0799994468689
Number of Epoch = 11 - Average Training Lost:= 0.6262708203125
Training Accuracy = 80.28600215911865
Number of Epoch = 12 - Average Training Lost:= 0.556461484375
Training Accuracy = 81.42399787902832
Number of Epoch = 13 - Average Training Lost:= 0.52024890625
Training Accuracy = 82.22200274467468
Number of Epoch = 14 - Average Training Lost:= 0.4954332421875
Training Accuracy = 82.4400007724762
Number of Epoch = 15 - Average Training Lost:= 0.4764317578125
Training Accuracy = 83.27599763870239

```

Total time taken (in seconds): 588.03



```

Test CCE: 0.1028
test accuracy = 82.1300048828125

```

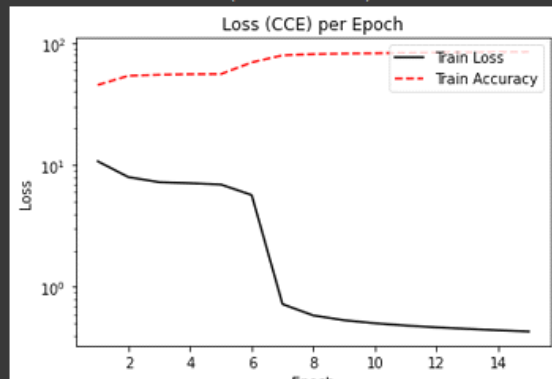
SEED 9

```

Number of Epoch = 1 - Average Training Lost:= 10.7343825
Training Accuracy = 45.34800052642822
Number of Epoch = 2 - Average Training Lost:= 7.957598125
Training Accuracy = 54.05200123786926
Number of Epoch = 3 - Average Training Lost:= 7.233955
Training Accuracy = 54.99799847602844
Number of Epoch = 4 - Average Training Lost:= 7.100541875
Training Accuracy = 55.57600259780884
Number of Epoch = 5 - Average Training Lost:= 6.92893125
Training Accuracy = 55.70799708366394
Number of Epoch = 6 - Average Training Lost:= 5.6757075
Training Accuracy = 69.52999830245972
Number of Epoch = 7 - Average Training Lost:= 0.723988359375
Training Accuracy = 79.36999797821045
Number of Epoch = 8 - Average Training Lost:= 0.5844152734375
Training Accuracy = 81.31600022315979
Number of Epoch = 9 - Average Training Lost:= 0.5343752734375
Training Accuracy = 82.10600018501282
Number of Epoch = 10 - Average Training Lost:= 0.50467640625
Training Accuracy = 82.5160026550293
Number of Epoch = 11 - Average Training Lost:= 0.4831803515625
Training Accuracy = 83.39599967002869
Number of Epoch = 12 - Average Training Lost:= 0.466494140625
Training Accuracy = 83.67000222206116
Number of Epoch = 13 - Average Training Lost:= 0.4536593359375
Training Accuracy = 84.0719997882843
Number of Epoch = 14 - Average Training Lost:= 0.4416375390625
Training Accuracy = 84.4219982624054
Number of Epoch = 15 - Average Training Lost:= 0.43197078125
Training Accuracy = 84.60599780082703

```

Total time taken (in seconds): 971.45



```

Test CCE: 0.1048
test accuracy = 81.7300033569336

```

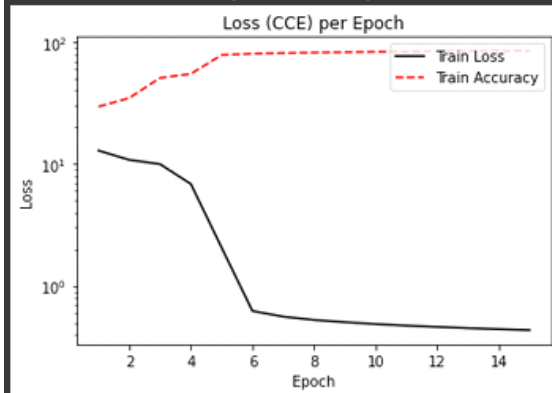
SEED 10

```

Number of Epoch = 3 - Average Training Loss:= 9.972456875
Training Accuracy = 50.88000297546387
Number of Epoch = 4 - Average Training Loss:= 6.85407375
Training Accuracy = 54.97400164604187
Number of Epoch = 5 - Average Training Loss:= 2.054109375
Training Accuracy = 78.52200269699097
Number of Epoch = 6 - Average Training Loss:= 0.6210481640625
Training Accuracy = 80.35799860954285
Number of Epoch = 7 - Average Training Loss:= 0.5583863671875
Training Accuracy = 81.44400119781494
Number of Epoch = 8 - Average Training Loss:= 0.5250376953125
Training Accuracy = 82.21799731254578
Number of Epoch = 9 - Average Training Loss:= 0.5031011328125
Training Accuracy = 82.66000151634216
Number of Epoch = 10 - Average Training Loss:= 0.4853822265625
Training Accuracy = 83.40399861335754
Number of Epoch = 11 - Average Training Loss:= 0.4707739453125
Training Accuracy = 83.75399708747864
Number of Epoch = 12 - Average Training Loss:= 0.4597463671875
Training Accuracy = 84.14000272750854
Number of Epoch = 13 - Average Training Loss:= 0.44946546875
Training Accuracy = 84.50000286102295
Number of Epoch = 14 - Average Training Loss:= 0.440620078125
Training Accuracy = 84.76200103759766
Number of Epoch = 15 - Average Training Loss:= 0.432945078125
Training Accuracy = 84.98799800872803

```

Total time taken (in seconds): 1006.90



```

Test CCE: 0.0991
test accuracy = 83.20000457763672

```