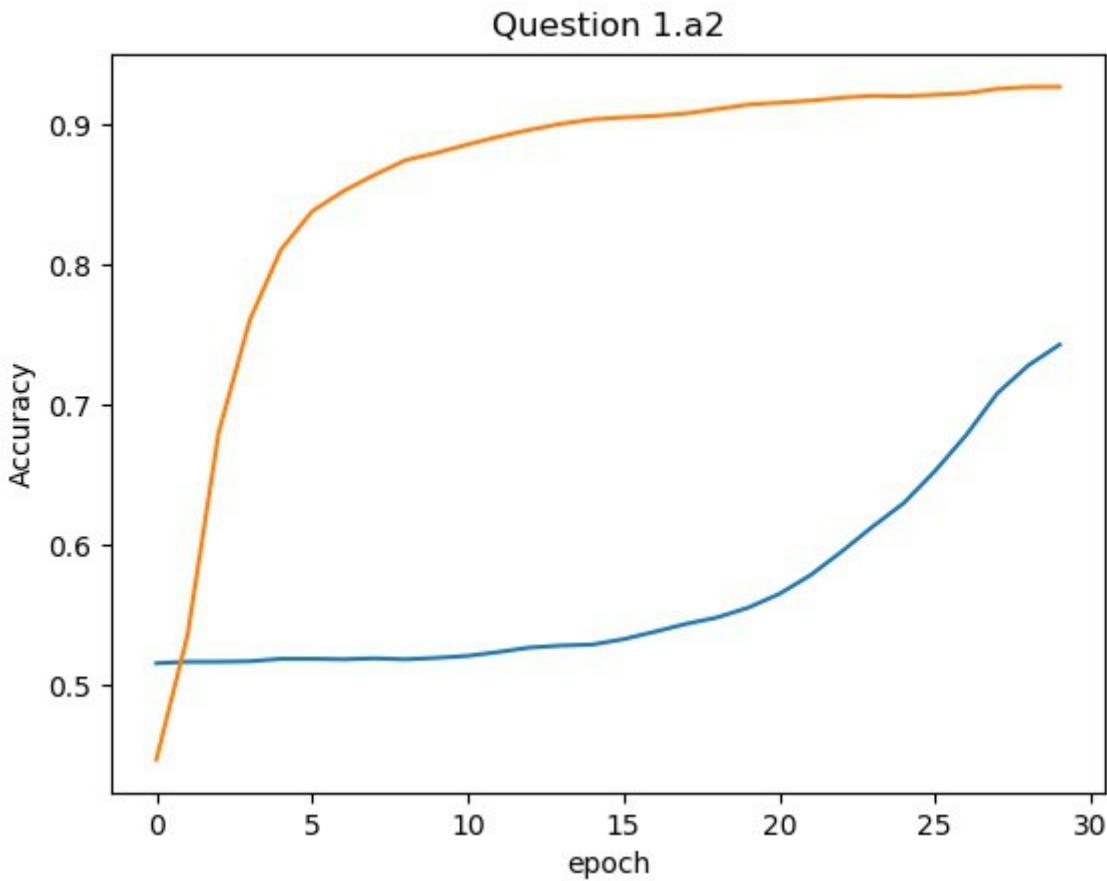Name:Arpan Mukherjee
Roll No: MT17007

Question1.a

Question 1.a1

Question 1.a2

Question 1.a3

Question 1.a4

Question1.b

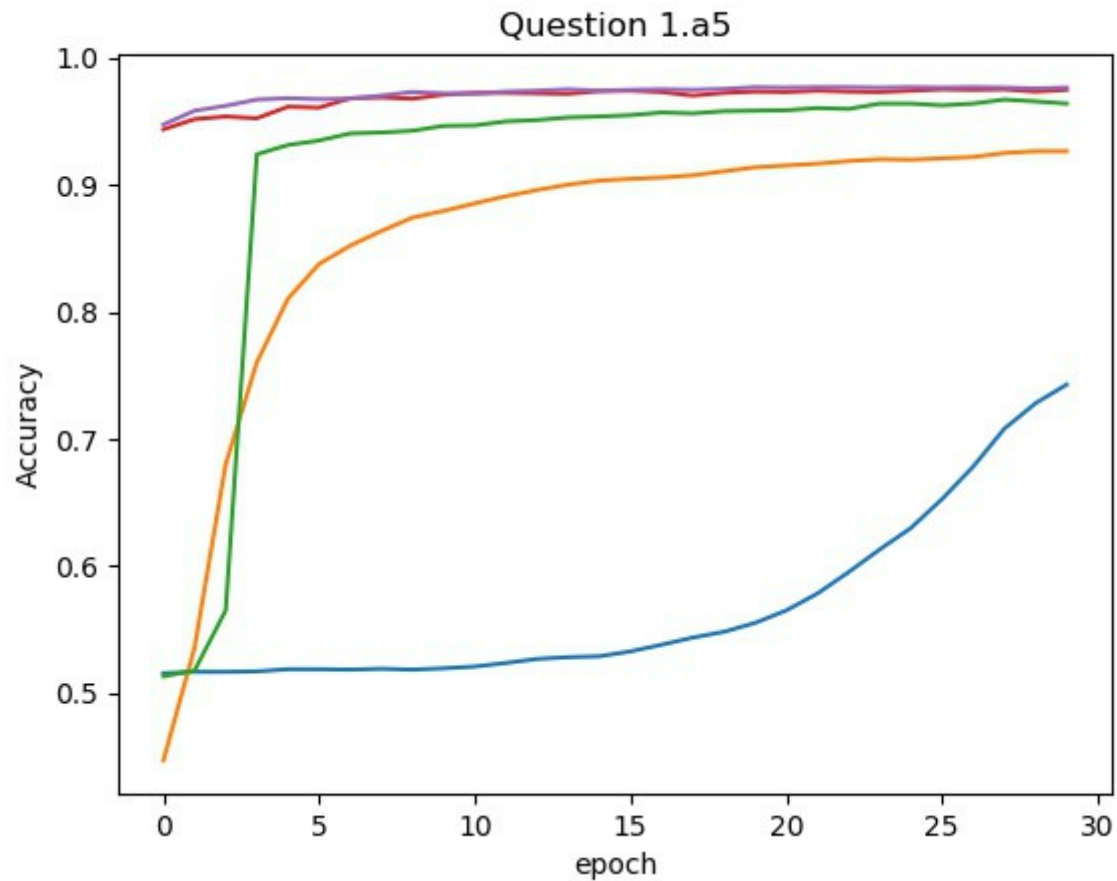**Question1.c**

Question2.a

Question2.b

Question3

Question 1.a5

Maximum accuracy for learning rate 0.001 is 0.742897229042
Maximum accuracy for learning rate 0.01 is 0.926692388636
Maximum accuracy for learning rate 0.1 is 0.967379866713
Maximum accuracy for learning rate 0.8 is 0.975447211505
Maximum accuracy for learning rate 0.9 is 0.977200982112

Question 1.b

Question 1.a5
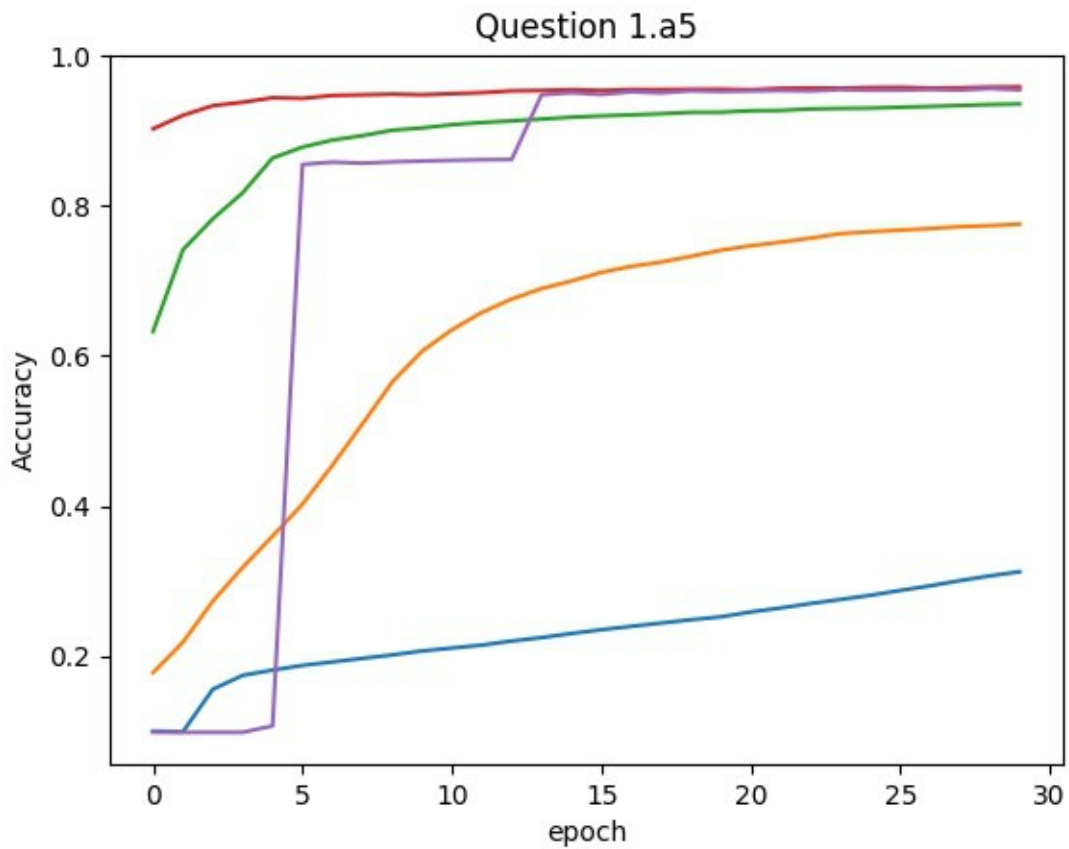
For learning rate: 0.001

Epoch No	Accuracy
1	0.0997
2	0.0989
3	0.1556
4	0.1741
5	0.1811
6	0.1874
7	0.192
8	0.1967
9	0.2013
10	0.2066
11	0.2105
12	0.2144
13	0.2199
14	0.2244
15	0.2299
16	0.2349

17	0.2394
18	0.2438
19	0.2482
20	0.2521
21	0.2586
22	0.2639
23	0.2698
24	0.2752
25	0.2808
26	0.2873
27	0.2934
28	0.3004
29	0.3067
30	0.3122

Maximum for this learning rate: 0.3122

For learning rate: 0.01

Epoch No	Accuracy
1	0.1777
2	0.2182
3	0.273
4	0.318
5	0.3596
6	0.4023
7	0.454
8	0.5089
9	0.5649
10	0.6061
11	0.6347
12	0.6578
13	0.6757
14	0.6896
15	0.6997
16	0.7113
17	0.7192
18	0.725
19	0.7326
20	0.7408
21	0.7468
22	0.7515

23   0.7569
24   0.7629
25   0.7654
26   0.7675
27   0.7697
28   0.7721
29   0.7735
30   0.7757
Maximum for this learning rate: 0.7757

For learning rate: 0.1

_____

Epoch No   Accuracy
1   0.6326
2   0.7414
3   0.7826
4   0.8174
5   0.8637
6   0.8782
7   0.8876
8   0.8935
9   0.9007
10   0.9038
11   0.9081
12   0.911
13   0.9132
14   0.9156
15   0.9181
16   0.9198
17   0.9212
18   0.9227
19   0.9246
20   0.9247
21   0.9267
22   0.9271
23   0.9291
24   0.9298
25   0.9302
26   0.9314
27   0.9325
28   0.9337

29   0.935
30   0.9357
Maximum for this learning rate: 0.9357

For learning rate: 0.8

_____
Epoch No   Accuracy
1   0.9026
2   0.9206
3   0.9335
4   0.938
5   0.944
6   0.9431
7   0.9471
8   0.9479
9   0.9488
10   0.948
11   0.9494
12   0.9508
13   0.9532
14   0.9537
15   0.9547
16   0.9537
17   0.9549
18   0.9548
19   0.9554
20   0.9555
21   0.9547
22   0.9566
23   0.957
24   0.9568
25   0.9577
26   0.9579
27   0.957
28   0.9573
29   0.9583
30   0.9585
Maximum for this learning rate: 0.9585
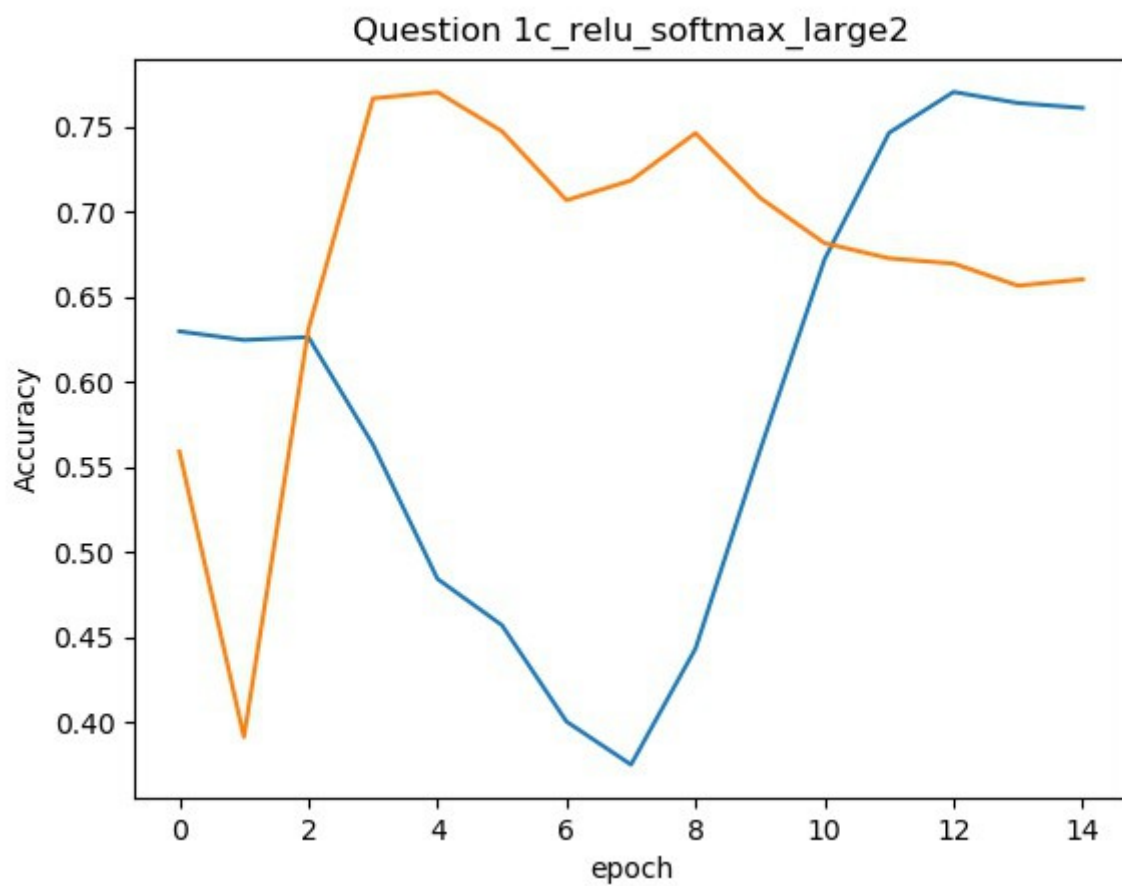

For learning rate: 0.9

Epoch No	Accuracy
1	0.0982
2	0.0982
3	0.0982
4	0.0982
5	0.1067
6	0.8551
7	0.8583
8	0.8568
9	0.8585
10	0.8597
11	0.8606
12	0.8614
13	0.8617
14	0.948
15	0.9507
16	0.9484
17	0.952
18	0.9505
19	0.9533
20	0.9525
21	0.953
22	0.9536
23	0.9531
24	0.9549
25	0.9541
26	0.9542
27	0.955
28	0.9543
29	0.9563
30	0.9546

Maximum for this learning rate: 0.9563

Question 1.c

For Relu:
    a) Softmax With Large datset

Question 1c_relu_softmax_large1

Question 1c_relu_softmax_large2

Question 1c_relu_softmax_large3
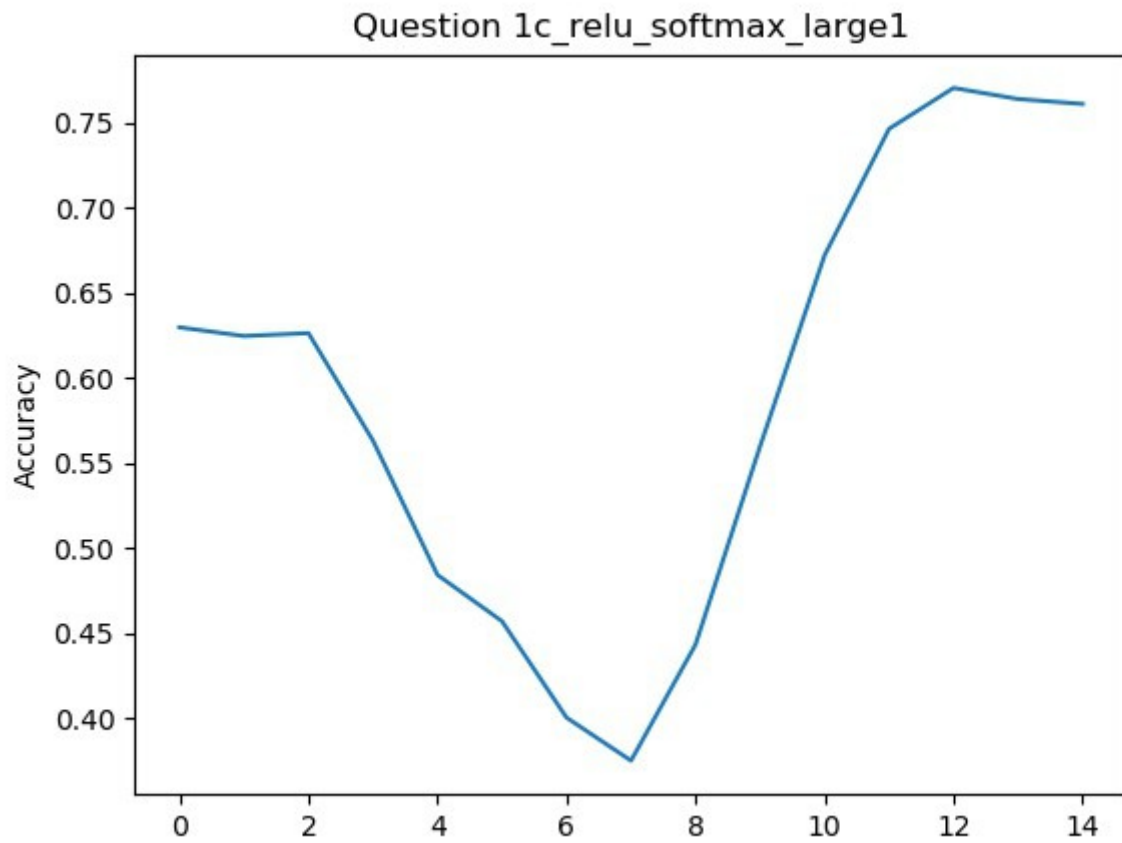
Question 1c_relu_softmax_large4
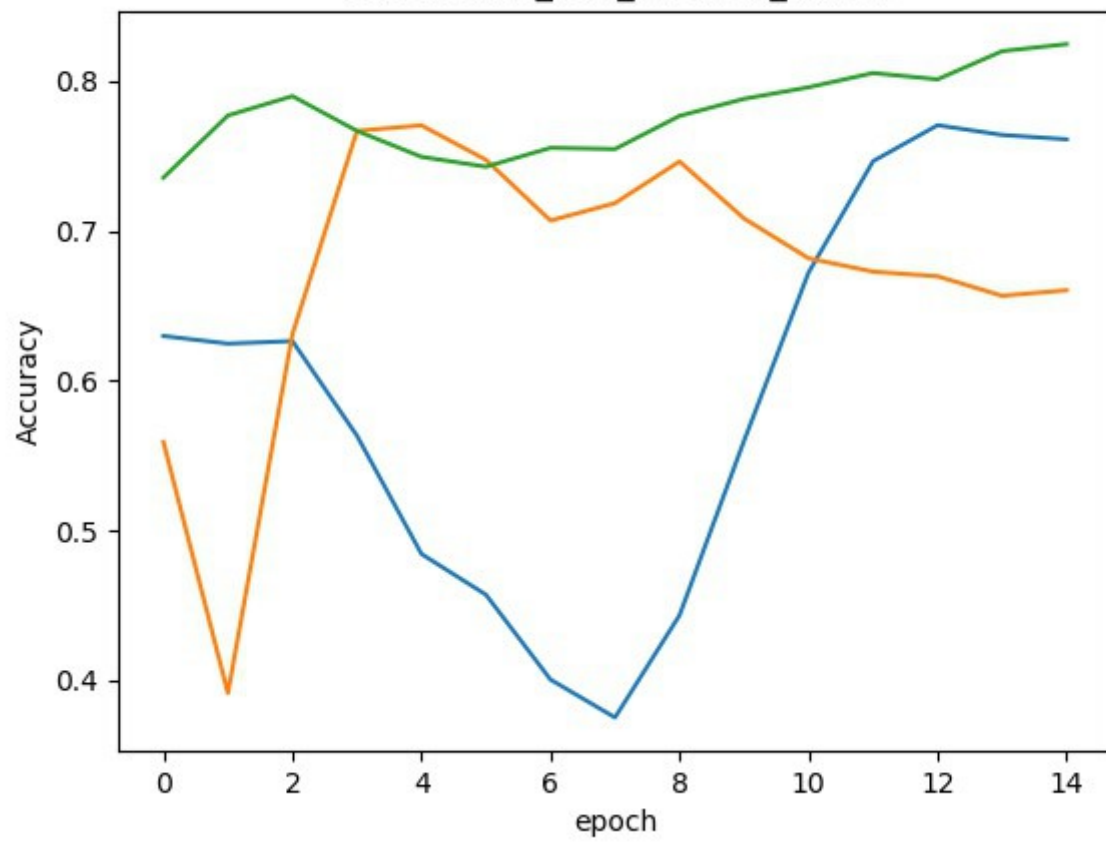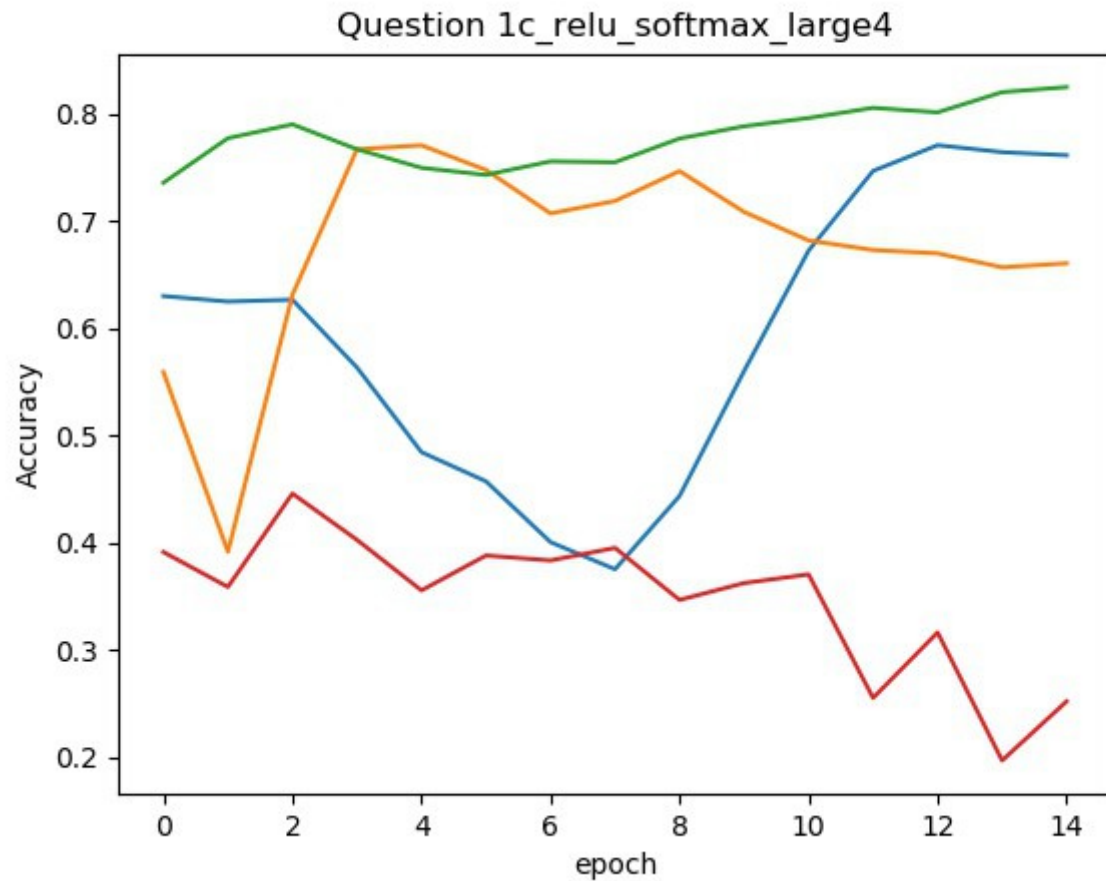
For learning rate: 0.001

Epoch No	Accuracy
1	0.6299
2	0.6248
3	0.6265
4	0.5634
5	0.4845
6	0.4573
7	0.4007
8	0.3754
9	0.4436
10	0.56
11	0.6722
12	0.7465
13	0.7705
14	0.764
15	0.7611

Maximum for this learning rate: 0.7705

For learning rate: 0.003

_____

Epoch No   Accuracy
1   0.5593
2   0.3916
3   0.6311
4   0.7667
5   0.7704
6   0.7474
7   0.7069
8   0.7185
9   0.7463
10   0.7083
11   0.6817
12   0.6728
13   0.6697
14   0.6567
15   0.6604
Maximum for this learning rate: 0.7704

For learning rate: 0.01

_____

Epoch No   Accuracy
1   0.7355
2   0.777
3   0.7899
4   0.7667
5   0.7494
6   0.7428
7   0.7554
8   0.7546
9   0.7767
10   0.7881
11   0.7958
12   0.8053
13   0.8011
14   0.8199
15   0.8246
Maximum for this learning rate: 0.8246

For learning rate: 0.1

_____

Epoch No	Accuracy
1	0.3914
2	0.3589
3	0.4459
4	0.4028
5	0.3557
6	0.3882
7	0.3836
8	0.3953
9	0.3468
10	0.3625
11	0.3706
12	0.2555
13	0.3165
14	0.1972
15	0.2523

Maximum for this learning rate: 0.4459

b)sigmoid with small dataset

Question 1c_relu_sig_small_4
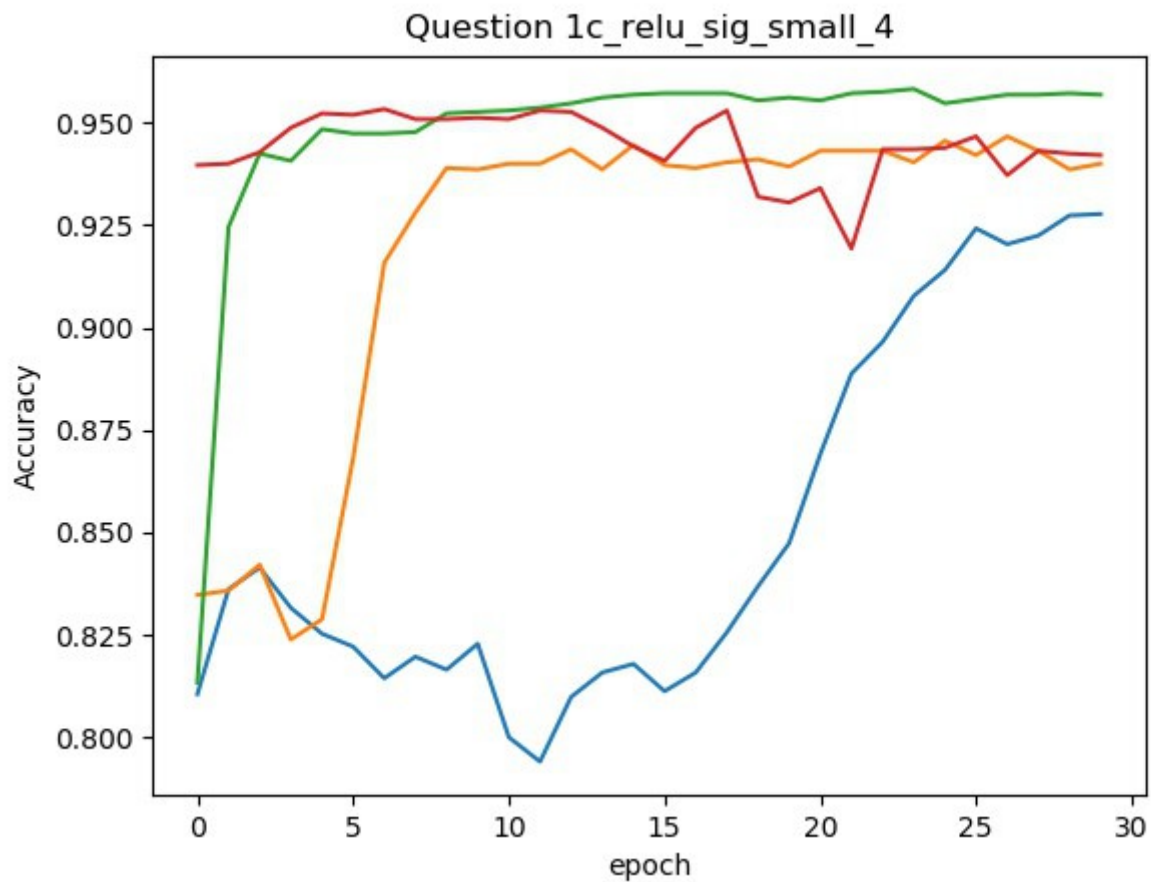
For learning rate: 0.001

Epoch No	Accuracy
1	0.810592774465
2	0.836197825324
3	0.841459137145
4	0.831638021747
5	0.825324447562
6	0.82216766047
7	0.8144510698
8	0.81971238162
9	0.816555594528
10	0.822869168713
11	0.800070150824
12	0.794107330761
13	0.809891266222
14	0.815854086286
15	0.817958611014
16	0.81294282708
17	0.815854086286

18	0.825675201684
19	0.836899333567
20	0.847421957208
21	0.869168712732
22	0.888810943529
23	0.896527534199
24	0.907751666082
25	0.914065240267
26	0.924237109786
27	0.920378814451
28	0.922483339179
29	0.927393896878
30	0.927744651

Maximum for this learning rate: 0.927744651

For learning rate: 0.003

_____

Epoch No	Accuracy
1	0.834794808839
2	0.835847071203
3	0.842160645388
4	0.823921431077
5	0.828831988776
6	0.868116450368
7	0.915819010873
8	0.928095405121
9	0.938968782883
10	0.938618028762
11	0.940021045247
12	0.940021045247
13	0.943528586461
14	0.938618028762
15	0.944580848825
16	0.939670291126
17	0.938968782883
18	0.940371799369
19	0.941073307611
20	0.939319537005
21	0.94317783234
22	0.94317783234
23	0.94317783234

Epoch No	Accuracy
24	0.940371799369
25	0.945633111189
26	0.94212556 9975
27	0.946685373553
28	0.94317783234
29	0.938618028762
30	0.940021045247

Maximum for this learning rate: 0.946685373553

For learning rate: 0.01

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Epoch No	Accuracy
1	0.813398807436
2	0.924587863907
3	0.942476324097
4	0.94072255349
5	0.94843914416
6	0.947386881796
7	0.947386881796
8	0.947737635917
9	0.952297439495
10	0.952648193616
11	0.952998947738
12	0.95370045598
13	0.954752718344
14	0.95615573483
15	0.956857243073
16	0.957207997194
17	0.957207997194
18	0.957207997194
19	0.955454226587
20	0.95615573483
21	0.955454226587
22	0.957207997194
23	0.957558751315
24	0.958260259558
25	0.954752718344
26	0.955804980709
27	0.956857243073
28	0.956857243073
29	0.957207997194

30   0.956857243073
Maximum for this learning rate: 0.958260259558

For learning rate: 0.1

_____

Epoch No	Accuracy
1	0.939670291126
2	0.940021045247
3	0.942827078218
4	0.948789898281
5	0.952297439495
6	0.951946685374
7	0.953349701859
8	0.950894423009
9	0.950894423009
10	0.951245177131
11	0.950894423009
12	0.952998947738
13	0.952648193616
14	0.948789898281
15	0.944230094704
16	0.94072255349
17	0.948789898281
18	0.952998947738
19	0.931953700456
20	0.930550683971
21	0.934058225184
22	0.919326552087
23	0.943528586461
24	0.943528586461
25	0.943879340582
26	0.946685373553
27	0.937215012276
28	0.94317783234
29	0.942476324097
30	0.942125569975

Maximum for this learning rate: 0.953349701859

c)Softmax for small dataset

Question 1c_relu_softmax_small_4
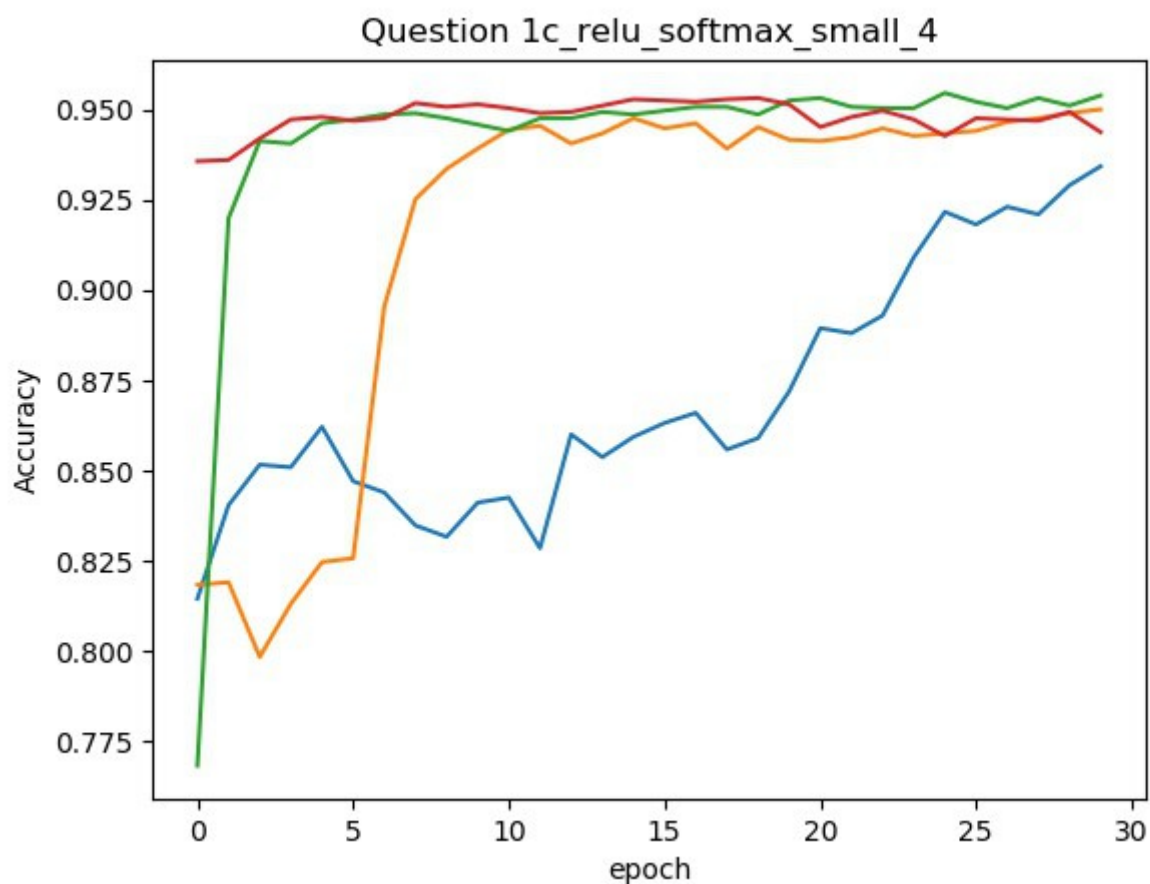
For learning rate: 0.001

Epoch No	Accuracy
1	0.8144510698
2	0.840406874781
3	0.851631006664
4	0.850929498422
5	0.862153630305
6	0.847071203087
7	0.843914415994
8	0.834794808839
9	0.831638021747
10	0.841108383024
11	0.842511399509
12	0.828481234655
13	0.860049105577
14	0.853735531392
15	0.859347597334
16	0.863205892669
17	0.86601192564

Epoch No	Accuracy
18	0.855840056121
19	0.858996843213
20	0.871974745703
21	0.889512451771
22	0.888109435286
23	0.893019992985
24	0.909154682568
25	0.921781830937
26	0.918274289723
27	0.923184847422
28	0.921080322694
29	0.929147667485
30	0.934408979306

Maximum for this learning rate: 0.934408979306

For learning rate: 0.003

_____

Epoch No	Accuracy
1	0.818309365135
2	0.819010873378
3	0.798316380217
4	0.813048053315
5	0.82462293932
6	0.825675201684
7	0.895475271834
8	0.92528937215
9	0.933707471063
10	0.939319537005
11	0.944580848825
12	0.945633111189
13	0.94072255349
14	0.943528586461
15	0.947737635917
16	0.944931602946
17	0.946334619432
18	0.939319537005
19	0.945282357068
20	0.941774815854
21	0.941424061733
22	0.942476324097
23	0.944931602946

24	0.942827078218
25	0.943528586461
26	0.944230094704
27	0.946685373553
28	0.947737635917
29	0.949140652403
30	0.950192914767

Maximum for this learning rate: 0.950192914767

For learning rate: 0.01

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Epoch No	Accuracy
1	0.76815152578
2	0.92002806033
3	0.941424061733
4	0.94072255349
5	0.946334619432
6	0.947386881796
7	0.948789898281
8	0.949140652403
9	0.947737635917
10	0.94598386531
11	0.944230094704
12	0.947737635917
13	0.947737635917
14	0.949491406524
15	0.948789898281
16	0.949842160645
17	0.950894423009
18	0.950894423009
19	0.948789898281
20	0.952648193616
21	0.953349701859
22	0.950894423009
23	0.950543668888
24	0.950543668888
25	0.954752718344
26	0.952297439495
27	0.950543668888
28	0.953349701859
29	0.951245177131

30   0.954051210102
Maximum for this learning rate: 0.954752718344

For learning rate: 0.1

_____

Epoch No   Accuracy
1   0.935811995791
2   0.936162749912
3   0.942125569975
4   0.947386881796
5   0.948088390039
6   0.947036127675
7   0.947737635917
8   0.951946685374
9   0.950894423009
10   0.951595931252
11   0.950543668888
12   0.949140652403
13   0.949491406524
14   0.951245177131
15   0.952998947738
16   0.952648193616
17   0.952297439495
18   0.952998947738
19   0.953349701859
20   0.951595931252
21   0.945282357068
22   0.948088390039
23   0.94984216O645
24   0.947386881796
25   0.942827078218
26   0.947737635917
27   0.947386881796
28   0.947036127675
29   0.949491406524
30   0.943879340582
Maximum for this learning rate: 0.953349701859

Question 2.a
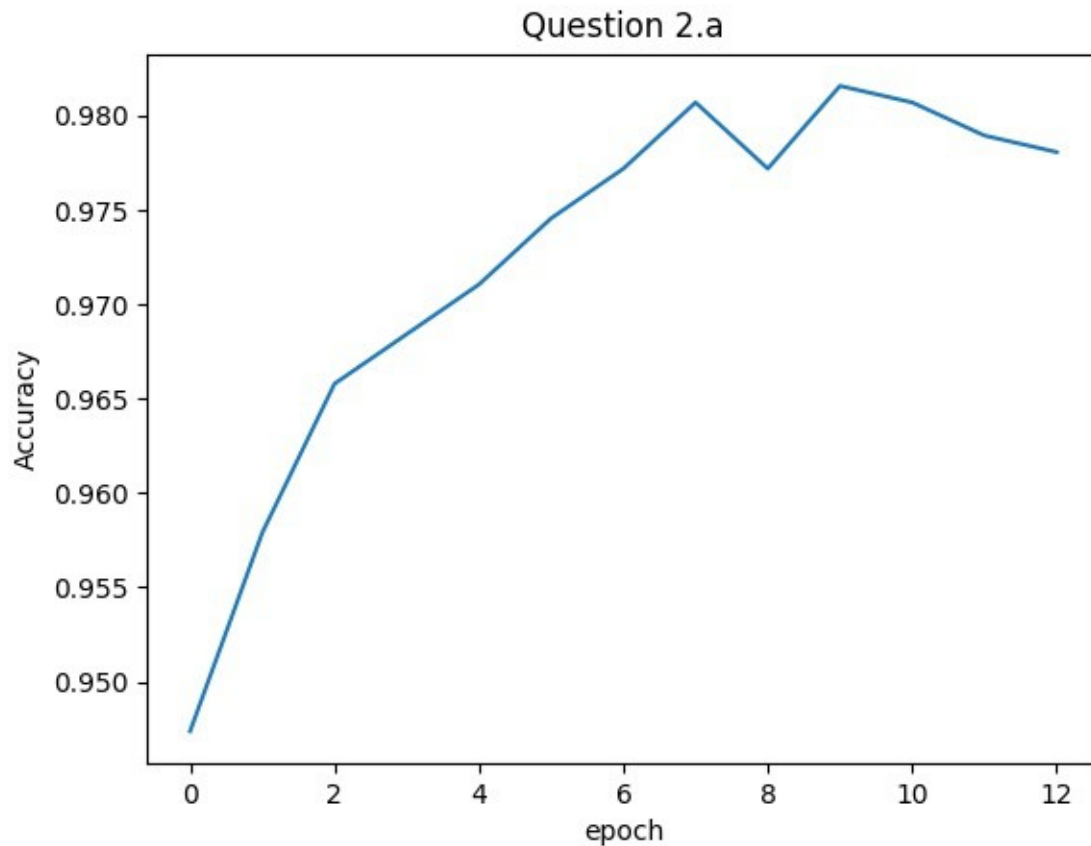
For the alpha value 0.001 the accuracy is 0.973342686777
For the alpha value 0.01 the accuracy is 0.979656260961
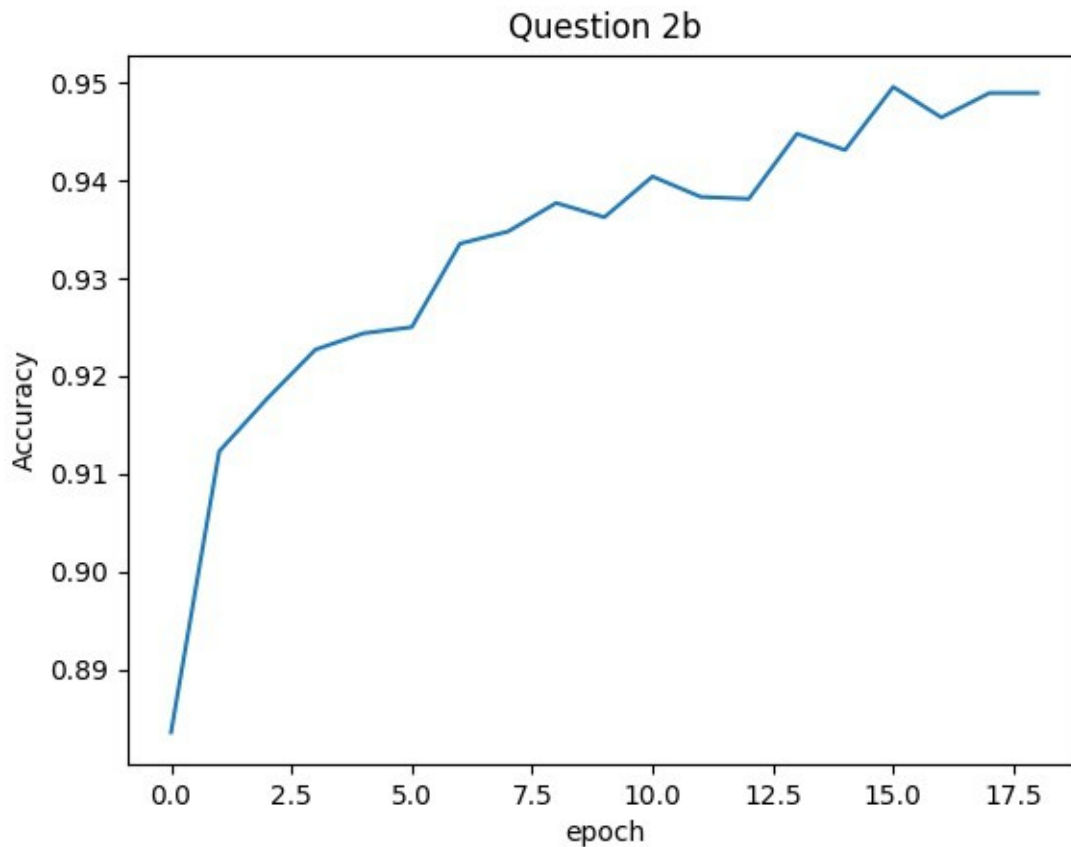For the alpha value 0.1 the accuracy is 0.976499473869
For the alpha value 0.2 the accuracy is 0.983865310417
For the alpha value 0.8 the accuracy is 0.981760785689
For the alpha value 1.0 the accuracy is 0.978253244476

Maximum score is 0.983865310417

Question 2.b

For the alpha value 0.001 the accuracy is 0.929416666667
For the alpha value 0.01 the accuracy is 0.932083333333
For the alpha value 0.1 the accuracy is 0.94775
For the alpha value 0.2 the accuracy is 0.936166666667
For the alpha value 0.8 the accuracy is 0.93725
For the alpha value 1.0 the accuracy is 0.929333333333

Maximum score is 0.94775