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Question 1(b).

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accuracy: 0.7818

precision: 0.761270801815

recall: 0.5032

Question 1(c).

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accuracy: 0.8178

precision: 0.77241047825

recall: 0.6428

Question 1(d).

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accuracy: 0.822

precision: 0.755819060167

recall: 0.6884

Question 1(e).

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accuracy: 0.821666666667

precision: 0.759312960071

recall: 0.6808

Question 3(a).

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validation accuracy of trained net 1: 0.927

validation accuracy of trained net 2: 0.9279

validation accuracy of trained net 3: 0.9274

validation accuracy of trained net 4: 0.934

validation accuracy of trained net 5: 0.9293

validation accuracy of trained net 6: 0.9306

validation accuracy of trained net 7: 0.9274

validation accuracy of trained net 8: 0.9324

validation accuracy of trained net 9: 0.9328

validation accuracy of trained net 10: 0.9296

maximum validation accuracy: 0.934

test accuracy: 0.9384

cross entropy: 329.627352895

learning rate used: 1.0

Question 3(b).

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validation accuracy of trained net 1: 0.7972

validation accuracy of trained net 2: 0.7992

validation accuracy of trained net 3: 0.8012

validation accuracy of trained net 4: 0.797

validation accuracy of trained net 5: 0.7894

validation accuracy of trained net 6: 0.7995

validation accuracy of trained net 7: 0.8001

validation accuracy of trained net 8: 0.8009

validation accuracy of trained net 9: 0.795

validation accuracy of trained net 10: 0.7955

maximum validation accuracy: 0.8012

test accuracy: 0.8108

cross entropy: 8104.27189644

learning rate used: 1.0

Question 3(c).

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training accuracy (after 50 iterations): 0.9347

test accuracy (after 50 iterations): 0.9195

cross entropy (after 50 iterations): 2283.80850024

training accuracy (after 200 iterations): 0.9836

test accuracy (after 200 iterations): 0.942

cross entropy (after 200 iterations): 780.096560917

Question 3(d).

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validation accuracy of trained net 1: 0.8445

validation accuracy of trained net 2: 0.8443

validation accuracy of trained net 3: 0.8421

validation accuracy of trained net 4: 0.8466

validation accuracy of trained net 5: 0.857

validation accuracy of trained net 6: 0.8474

validation accuracy of trained net 7: 0.8559

validation accuracy of trained net 8: 0.8136

validation accuracy of trained net 9: 0.851

validation accuracy of trained net 10: 0.8591

maximum validation accuracy: 0.8591

test accuracy: 0.8678

cross entropy: 3594.67434691

learning rate used: 10.0

Question 3(e).

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validation accuracy of trained net 1: 0.8937

validation accuracy of trained net 2: 0.8951

validation accuracy of trained net 3: 0.8943

validation accuracy of trained net 4: 0.9016

validation accuracy of trained net 5: 0.8915

validation accuracy of trained net 6: 0.8976

validation accuracy of trained net 7: 0.8984

validation accuracy of trained net 8: 0.8967

validation accuracy of trained net 9: 0.8946

validation accuracy of trained net 10: 0.8986

maximum validation accuracy: 0.9016

test accuracy: 0.9117

cross entropy: 442.608501639

learning rate used: 1.0

Question 3(f).

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test accuracy after epoch #1 is : 0.8915

test accuracy after epoch #10 is : 0.944

test accuracy after epoch #20 is : 0.954

test accuracy after epoch #30 is : 0.9586

test accuracy after epoch #40 is : 0.958

test accuracy after epoch #50 is : 0.9601

test accuracy after epoch #60 is : 0.9591

test accuracy after epoch #70 is : 0.9606

test accuracy after epoch #80 is : 0.96

test accuracy after epoch #90 is : 0.9598

test accuracy after epoch #100 is : 0.9606

final train accuracy: 0.9998

final test accuracy: 0.9606

final cross entropy: 42.8269897395

Question 3(g).

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test accuracy after epoch #1 is : 0.1867

test accuracy after epoch #10 is : 0.4271

test accuracy after epoch #20 is : 0.5909

test accuracy after epoch #30 is : 0.7218

test accuracy after epoch #40 is : 0.7098

test accuracy after epoch #50 is : 0.753

test accuracy after epoch #60 is : 0.7729

test accuracy after epoch #70 is : 0.7869

test accuracy after epoch #80 is : 0.8009

test accuracy after epoch #90 is : 0.8171

test accuracy after epoch #100 is : 0.8348

final train accuracy: 0.830766666667

final test accuracy: 0.8348

final cross entropy: 5809.24916712