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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: 0.9369

validation accuracy of trained net 2: 0.9249

validation accuracy of trained net 3: 0.9261

validation accuracy of trained net 4: 0.9256

validation accuracy of trained net 5: 0.9264

validation accuracy of trained net 6: 0.9289

validation accuracy of trained net 7: 0.9301

validation accuracy of trained net 8: 0.9292

validation accuracy of trained net 9: 0.9287

validation accuracy of trained net 10: 0.9331

maximum validation accuracy: 0.9369

test accuracy: 0.9425

cross entropy: 271.741386392

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): 0.9339

test accuracy (after 50 iterations): 0.9177

cross entropy (after 50 iterations): 2309.19289926

training accuracy (after 200 iterations): 0.9841

test accuracy (after 200 iterations): 0.9385

cross entropy (after 200 iterations): 775.079204549

Question 3(d).

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validation accuracy of trained net 1: 0.7081

validation accuracy of trained net 2: 0.6589

validation accuracy of trained net 3: 0.6926

validation accuracy of trained net 4: 0.7134

validation accuracy of trained net 5: 0.6832

validation accuracy of trained net 6: 0.6654

validation accuracy of trained net 7: 0.6122

validation accuracy of trained net 8: 0.645

validation accuracy of trained net 9: 0.679

validation accuracy of trained net 10: 0.7394

maximum validation accuracy: 0.7394

test accuracy: 0.7545

cross entropy: 7831.50794389

learning rate used: 1.0

Question 3(e).

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validation accuracy of trained net 1: 0.837

validation accuracy of trained net 2: 0.8291

validation accuracy of trained net 3: 0.8273

validation accuracy of trained net 4: 0.8257

validation accuracy of trained net 5: 0.8206

validation accuracy of trained net 6: 0.8358

validation accuracy of trained net 7: 0.8199

validation accuracy of trained net 8: 0.8461

validation accuracy of trained net 9: 0.8154

validation accuracy of trained net 10: 0.8418

maximum validation accuracy: 0.8461

test accuracy: 0.8615

cross entropy: 4721.85609366

learning rate used: 1.0

Question 3(f).

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test accuracy after epoch #1 is : 0.8676

test accuracy after epoch #10 is : 0.8917

test accuracy after epoch #20 is : 0.9068

test accuracy after epoch #30 is : 0.913

test accuracy after epoch #40 is : 0.918

test accuracy after epoch #50 is : 0.9221

test accuracy after epoch #60 is : 0.9226

test accuracy after epoch #70 is : 0.9184

test accuracy after epoch #80 is : 0.9223

test accuracy after epoch #90 is : 0.9238

test accuracy after epoch #100 is : 0.9258

final train accuracy: 0.929816666667

final test accuracy: 0.9258

final cross entropy: 2481.34892728

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