# Homework 1: Autoregressive Models

Deliverable: This PDF write-up by **Tuesday February 11th, 23:59pm**. Your PDF should be generated by simply replacing the placeholder images of this LaTeX document with the appropriate solution images that will be generated automatically when solving each question. The solution images are automatically generated and saved using the accompanying IPython notebook. Your PDF is to be submitted into Gradescope. This PDF already contains a few solution images. These images will allow you to check your own solution to ensure correctness.
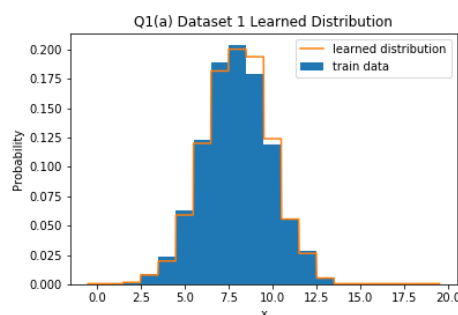
Question 1: 1D Data

(a) **[10pt] Fitting a Histogram**

Final test loss for dataset 1: 2.0553 nats / dim
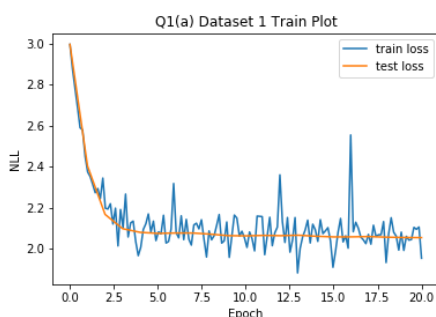
(a) Dataset 1: Training curve

(b) Dataset 1: Learned distribution

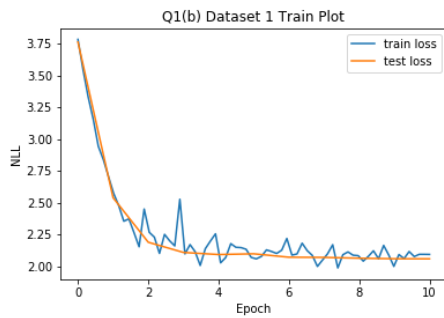Final test loss for dataset 2: 0.0000 nats / dim
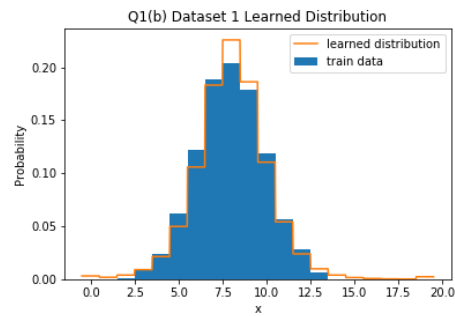
Placeholder

Placeholder

(a) Dataset 2: Training curve

(b) Dataset 2: Learned distribution

(b) **[10pth] Fitting Discretized Mixture of Logistics**

Final test loss for dataset 1: 2.0586 nats / dim

(a) Dataset 1: Training curve

(b) Dataset 1: Learned distribution
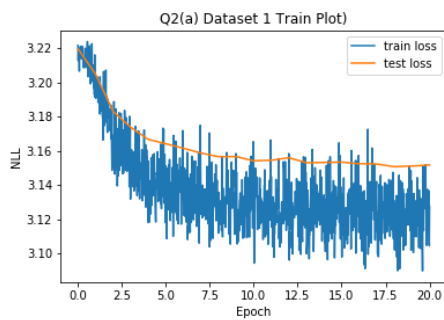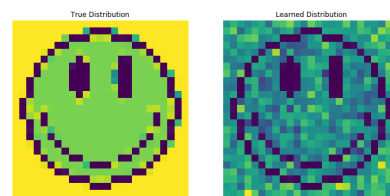
Final test loss for dataset 2: 0.0000 nats / dim

(a) Dataset 2: Training curve

(b) Dataset 2: Learned distribution

Question 2: MADE

(a) **[10pt] Fitting 2D Data**

Final test loss for dataset 1: 3.1518 nats / dim

(a) Dataset 1: Training curve

(b) Dataset 1: Learned distribution
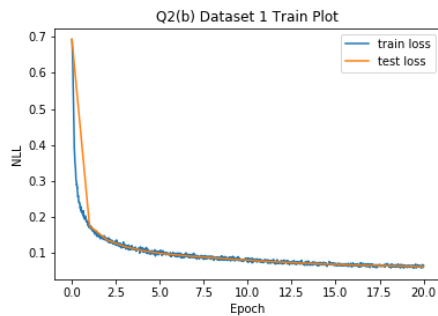
Final test loss for dataset 2: 0.0000 nats / dim

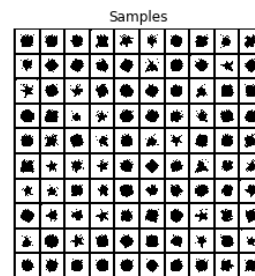(a) Dataset 2: Training curve

(b) Dataset 2: Learned distribution

(b) **[10pt] Shapes and MNIST**

Final test loss for dataset 1: 0.0623 nats / dim

(a) Dataset 1: Training curve

(b) Dataset 1: Samples

Final test loss for dataset 2: 0.0000 nats / dim

Placeholder

Placeholder

(a) Dataset 2: Training curve

(b) Dataset 2: Samples

Question 3: PixelCNNs

(a) **[15pt] PixelCNNs on Shapes and MNIST**

Final test loss for dataset 1: 0.0420 nats / dim

(a) Dataset 1: Training curve

(b) Dataset 1: Samples

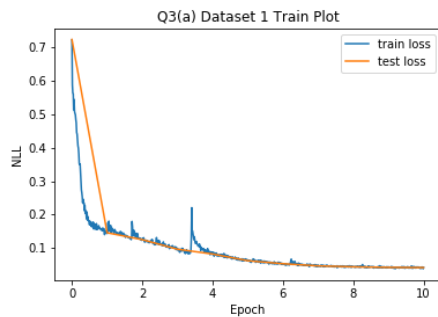Final test loss for dataset 2: 0.0000 nats / dim
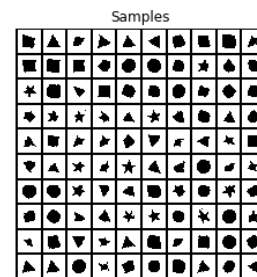
Placeholder

Placeholder

(a) Dataset 2: Training curve

(b) Dataset 2: Samples

(b) **[15pt] PixelCNN on Colored Shapes and MNIST: Independent Color Channels**

Final test loss for dataset 1: 0.0444 nats / dim

(a) Dataset 1: Training curve

(b) Dataset 1: Samples

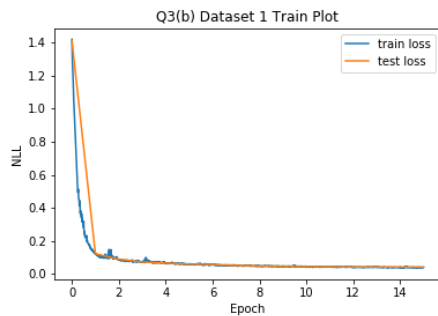Final test loss for dataset 2: 0.0000 nats / dim

Placeholder

Placeholder
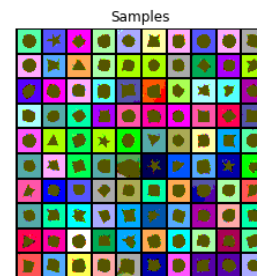
(a) Dataset 2: Training curve

(b) Dataset 2: Samples

(c) **[15pt] PixelCNN on Colored Shapes and MNIST: Autoregressive Color Channels**

Final test loss for dataset 1: 0.0236 nats / dim

(a) Dataset 1: Training curve

(b) Dataset 1: Samples

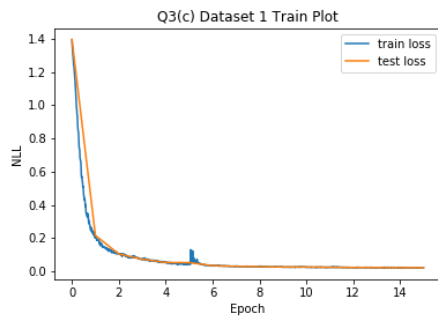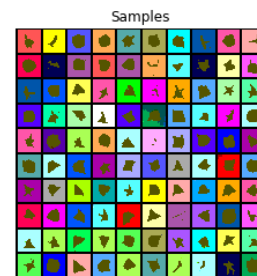Final test loss for dataset 2: 0.0000 nats / dim

Placeholder

Placeholder

(a) Dataset 2: Training curve

(b) Dataset 2: Samples

(d) **[15pt] Conditional PixelCNNs**

Final test loss for dataset 1: 0.0368 nats / dim

(a) Dataset 1: Training curve

(b) Dataset 1: Samples

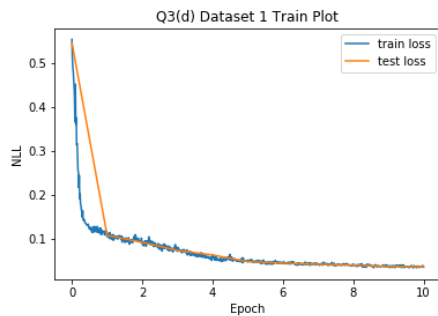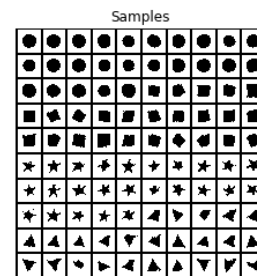Final test loss for dataset 2: 0.0000 nats / dim

Placeholder

Placeholder

(a) Dataset 2: Training curve

(b) Dataset 2: Samples

Bonus Questions (Optional)

1. **[10pt] Gated PixelCNN**

   Final test loss: 0.0000 nats / dim

   Placeholder   Placeholder

   (a) Training curve   (b) Samples

2. **[10pt] Grayscale PixelCNN**

   Final test loss: 0.0000 nats / dim

   Placeholder   Placeholder

   (a) Training curve   (b) Samples

3. **[10pt] Parallel Multiscale PixelCNN**

   Final test loss: 0.0000 nats / dim

   Placeholder   Placeholder

   (a) Training curve   (b) Samples