

```
In [1]: import numpy as np
import torch
import torch.nn as nn
import torch.nn.functional as F
from torch.utils.data import DataLoader
from torchvision import datasets, transforms
import matplotlib.pyplot as plt
import pandas as pd
import einops
from einops.layers.torch import Reduce
```

```
In [2]: device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')
print(device)
```

cuda

```
In [3]: #データ確認
df_train = pd.read_csv("./data/ECG/mitbih_train.csv", header = None)
df_test = pd.read_csv("./data/ECG/mitbih_test.csv", header = None)
train_size = 80000
test_size = 20000
print(df_train.shape)
print(df_test.shape)
```

(87554, 188)

(21892, 188)

```
In [4]: #データ成形
# train_size = 20000
# test_size = 4000
# df_train = df_train[60000:]
# df_test = df_test[17000:]
# print(df_train.shape)
# print(df_test.shape)
```

```
In [5]: #一応5種類の心電図を可視化してみる
# class_list = ["N", "S", "V", "F", "Q"]
# j = 0
# for i in range(5):
#     while True:
#         if( df_train.iloc[j][187] == i):
#             one_line = df_train.iloc[j][:186].to_list()
#             plt.plot(range(1, len(one_line)+1), one_line, label= class_list[i] )
#             plt.xlabel('ecg')
#             plt.legend()
#             plt.figure()
#             j += 1
#             break
#         else:
#             j += 1
```

```
In [6]: #HPパラメータ
learning_rate = 0.001
batch_size = 64
epochs = 20
#結果保存用
history = {
    'train_loss' : [],
```

```

    'test_loss':[],
    'test_acc':[]
}

```

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In [7]: #訓練データセット
T = torch.FloatTensor(df_train.drop(df_train.columns[[187]], axis=1).values)
y = torch.LongTensor(df_train[187].values)
T = T.unsqueeze(1)
train_dataset = torch.utils.data.TensorDataset(T, y)

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In [8]: #テストデータセット
T = torch.FloatTensor(df_test.drop(df_test.columns[[187]], axis=1).values)
y = torch.LongTensor(df_test[187].values)
T = T.unsqueeze(1)
test_dataset = torch.utils.data.TensorDataset(T, y)

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In [9]: class LinearEmbedding(nn.Sequential):

    def __init__(self, input_channels, output_channels) -> None:
        super().__init__(*
            nn.Linear(input_channels, output_channels),
            nn.LayerNorm(output_channels),
            nn.GELU()
        )
        self.cls_token = nn.Parameter(torch.randn(1, output_channels))

    def forward(self, x):
        embedded = super().forward(x)
        return torch.cat([einops.repeat(self.cls_token, "n e -> b n e", b=x.shape[0])

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In [10]: class MLP(nn.Sequential):
    def __init__(self, input_channels, expansion=4):
        super().__init__(*
            nn.Linear(input_channels, input_channels * expansion),
            nn.GELU(),
            nn.Linear(input_channels * expansion, input_channels)
        )

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In [11]: class ResidualAdd(torch.nn.Module):
    def __init__(self, block):
        super().__init__()
        self.block = block

    def forward(self, x):
        return x + self.block(x)

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In [12]: #マルチヘッドアテンション
class MultiHeadAttention(torch.nn.Module):
    def __init__(self, embed_size, num_heads, attention_store=None):
        super().__init__()
        self.queries_projection = nn.Linear(embed_size, embed_size)
        self.values_projection = nn.Linear(embed_size, embed_size)
        self.keys_projection = nn.Linear(embed_size, embed_size)
        self.final_projection = nn.Linear(embed_size, embed_size)
        self.embed_size = embed_size
        self.num_heads = num_heads

    def forward(self, x):

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assert len(x.shape) == 3
keys = self.keys_projection(x)
values = self.values_projection(x)
queries = self.queries_projection(x)
keys = einops.rearrange(keys, "b n (h e) -> b n h e", h=self.num_heads)
queries = einops.rearrange(queries, "b n (h e) -> b n h e", h=self.num_heads)
values = einops.rearrange(values, "b n (h e) -> b n h e", h=self.num_heads)
energy_term = torch.einsum("bqhe, bkhe -> bqhk", queries, keys)
divider = np.sqrt(self.embed_size)
mh_out = torch.softmax(energy_term, -1)
out = torch.einsum('bihv, bvhd -> bihd ', mh_out / divider, values)
out = einops.rearrange(out, "b n h e -> b n (h e)")
return self.final_projection(out)

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In [13]: class TransformerEncoderLayer(torch.nn.Sequential):
    def __init__(self, embed_size, expansion, num_heads, dropout = 0.1):
        super(TransformerEncoderLayer, self).__init__(
            *[
                ResidualAdd(nn.Sequential(*[
                    nn.LayerNorm(embed_size),
                    MultiHeadAttention(embed_size, num_heads),
                    nn.Dropout(dropout)
                ])),
                ResidualAdd(nn.Sequential(*[
                    nn.LayerNorm(embed_size),
                    MLP(embed_size, expansion),
                    nn.Dropout(dropout)
                ]))
            ]
        )

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In [14]: class Classifier(nn.Sequential):
    def __init__(self, embed_size, num_classes):
        super().__init__(*[
            Reduce("b n e -> b e", reduction="mean"),
            nn.Linear(embed_size, embed_size),
            nn.LayerNorm(embed_size),
            nn.Linear(embed_size, num_classes)
        ])

```

```
In [15]: class ECGformer(nn.Module):

    def __init__(self, num_layers, signal_length, num_classes, input_channels, e
        super().__init__()
        self.encoder = nn.ModuleList([TransformerEncoderLayer(
            embed_size=embed_size, num_heads=num_heads, expansion=expansion) for
        self.classifier = Classifier(embed_size, num_classes)
        self.positional_encoding = nn.Parameter(torch.randn(signal_length + 1 ,
        self.embedding = LinearEmbedding(input_channels, embed_size)

    def forward(self, x):
        embedded = self.embedding(x)
        #print(embedded.shape)
        for layer in self.encoder:
            # print(embedded[0].shape)
            # print(self.positional_encoding.shape)
            embedded = layer(embedded + self.positional_encoding)
            #print(embedded.shape)
        return self.classifier(embedded)
```

```
In [16]: #モデル生成・データロード
from torchsummary import summary
train_dataloader = DataLoader(train_dataset, batch_size=batch_size, shuffle=True)
test_dataloader = DataLoader(test_dataset, batch_size=batch_size, shuffle=True)
num_layers: int = 2
signal_length: int = 187
num_classes: int = 5
input_channels: int = 1
embed_size: int = 192
num_heads: int = 8
expansion: int = 4
model = ECGformer(num_layers, signal_length, num_classes, input_channels, embed
print(model)

#損失関数, 最適化
loss_fn = nn.CrossEntropyLoss(weight=torch.tensor([0.1, 0.4, 0.2, 0.5, 0.2]))
optimizer = torch.optim.AdamW(model.parameters(), lr=learning_rate)
```

```

ECGformer(
  (encoder): ModuleList(
    (0-1): 2 x TransformerEncoderLayer(
      (0): ResidualAdd(
        (block): Sequential(
          (0): LayerNorm((192,), eps=1e-05, elementwise_affine=True)
          (1): MultiHeadAttention(
            (queries_projection): Linear(in_features=192, out_features=192, bias=True)
            (values_projection): Linear(in_features=192, out_features=192, bias=True)
            (keys_projection): Linear(in_features=192, out_features=192, bias=True)
            (final_projection): Linear(in_features=192, out_features=192, bias=True)
          )
          (2): Dropout(p=0.1, inplace=False)
        )
      )
      (1): ResidualAdd(
        (block): Sequential(
          (0): LayerNorm((192,), eps=1e-05, elementwise_affine=True)
          (1): MLP(
            (0): Linear(in_features=192, out_features=768, bias=True)
            (1): GELU(approximate='none')
            (2): Linear(in_features=768, out_features=192, bias=True)
          )
          (2): Dropout(p=0.1, inplace=False)
        )
      )
    )
  )
  (classifier): Classifier(
    (0): Reduce('b n e -> b e', 'mean')
    (1): Linear(in_features=192, out_features=192, bias=True)
    (2): LayerNorm((192,), eps=1e-05, elementwise_affine=True)
    (3): Linear(in_features=192, out_features=5, bias=True)
  )
  (embedding): LinearEmbedding(
    (0): Linear(in_features=1, out_features=192, bias=True)
    (1): LayerNorm((192,), eps=1e-05, elementwise_affine=True)
    (2): GELU(approximate='none')
  )
)

```

```

In [17]: cnt = 0
for data in train_dataloader:
    print(data[0].shape, type(data[0]))
    print(data[1])
    print("=====")
    cnt += 1
    if cnt==3:
        break

```

```

torch.Size([64, 1, 187]) <class 'torch.Tensor'>
tensor([0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 4, 0, 0, 4,
        0, 0, 2, 0, 0, 2, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
        0, 4, 0, 0, 2, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0])
=====
torch.Size([64, 1, 187]) <class 'torch.Tensor'>
tensor([0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 2, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 4, 0, 4, 0])
=====
torch.Size([64, 1, 187]) <class 'torch.Tensor'>
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 4, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4])
=====

```

In [18]: #学習ループ

```

def train_loop(dataloader, model, loss_fn, optimizer):
    #size = len(dataloader.dataset)
    size = train_size
    num_batches = len(dataloader)
    model.train()
    sum_loss, avg_loss = 0, 0
    for batch, (X, y) in enumerate(dataloader):
        pred = model(einops.rearrange(X, "b c e -> b e c"))
        loss = loss_fn(pred, y)
        sum_loss += loss.item()

        # 逆伝播
        loss.backward()
        optimizer.step()
        optimizer.zero_grad()

        if batch % 100 == 0:
            loss, current = loss.item(), (batch + 1) * len(X)
            print(f"loss: {loss:>7f} [{current:>5d}/{size:>5d}]")
            print(pred.argmax(1))
            #print(pred)
            print(y)
        if( current > train_size ):
            break

    avg_loss = sum_loss / num_batches
    history['train_loss'].append(avg_loss)

```

In [19]: #評価ループ

```

def test_loop(dataloader, model, loss_fn):
    model.eval()
    size = len(dataloader.dataset)
    num_batches = len(dataloader)
    i = 1
    test_loss, correct = 0, 0
    finished = 0

    with torch.no_grad():
        for X,y in dataloader:
            if( finished > test_size ):
                break
            pred = model(einops.rearrange(X, "b c e -> b e c"))
            test_loss += loss_fn(pred, y).item()

```

```
        correct += (pred.argmax(1) == y).sum().item()
    finished = num_batches*i
    i += 1

test_loss /= num_batches
print(correct)
correct /= size
print(f"Test Error: \n Accuracy: {(100*correct):>0.1f}%, Avg loss: {test_loss}")
history['test_loss'].append(test_loss)
history['test_acc'].append(correct)
```

```
In [20]: #学習・評価
for t in range(epochs):
    print(f"Epoch {t+1}\n-----")
    train_loop(train_dataloader, model, loss_fn, optimizer)
    test_loop(test_dataloader, model, loss_fn)
print("Done!")
```

.....

```
tensor([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,  
        1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,  
        1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1])
```

loss: 1.001053 [ 6464/80000]

```
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 2, 0, 0, 0, 0, 0, 4, 0, 2, 0,
        0, 0, 0, 4, 4, 3, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0])
```

```
tensor([0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0,
        4, 0, 0, 0, 4, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0,
        0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4])
```

```
loss: 1.032634 [19264/80000]
```

```
tensor([0, 0, 0, 0, 1, 0, 2, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  
        2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 4, 0, 0, 0, 0, 0, 0,  
        0, 0, 0, 2, 0, 2, 0, 0, 4, 0, 0, 0, 2, 0, 0, 2])
```

```
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 4, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 4, 0, 0, 0])
```

```
loss: 0.526859 [32064/80000]
```

```
tensor([0, 4, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0])
```

```
loss: 0.633000 [38464/80000]
```

```
tensor([1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  
        0, 4, 0, 4, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0,  
        0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0, 0, 0, 0])
```

```
tensor([0, 0, 2, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 2, 0, 0,
        0, 4, 0, 0, 0, 2, 4, 0, 0, 0, 1, 0, 0, 0, 0, 0])
```

```
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 2, 2, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,
        3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0])
```

```
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 4, 0, 4, 2, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0])
```

```
tensor([0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 4, 0,
```



```
2, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 4, 0,
2, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 4, 0, 0, 0, 0, 4])
loss: 0.374413 [57664/80000]
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
0, 0, 2, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 4, 3, 0, 0, 0, 0, 0, 0, 0, 0,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 4])
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4,
0, 0, 4, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
loss: 0.293139 [64064/80000]
tensor([4, 4, 0, 4, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 4, 4, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0])
tensor([4, 4, 2, 4, 0, 0, 0, 0, 2, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0])
loss: 0.351019 [70464/80000]
tensor([0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 4, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
0, 4, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 2])
tensor([0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
0, 4, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 4, 2])
loss: 0.483744 [76864/80000]
tensor([0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 4,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
tensor([0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 4, 0, 4, 0, 4,
4, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
loss: 0.477382 [83264/80000]
tensor([0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0,
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4,
0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4])
tensor([0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0,
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 4,
0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2])
```

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Test Error:

Accuracy: 16.2%, Avg loss: 0.064154

Epoch 2

-----

```
loss: 0.252494 [ 64/80000]
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0,
0, 0, 0, 0, 4, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0,
0, 0, 4, 0, 4, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0])
loss: 0.372010 [ 6464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0,
0, 4, 0, 0, 2, 0, 4, 4, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0,
0, 4, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 1, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```

```
loss: 0.511293 [12864/80000]
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0])
tensor([0, 0, 2, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 4, 0])
loss: 0.609213 [19264/80000]
tensor([0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 0, 2, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 4, 0, 0,
        0, 0, 0, 1, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 2, 1, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 2, 2, 0, 4, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0])
loss: 0.347203 [25664/80000]
tensor([0, 0, 0, 4, 0, 0, 0, 4, 4, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 2])
tensor([0, 0, 0, 4, 0, 0, 0, 4, 4, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 4, 0, 0,
        0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2])
loss: 0.489372 [32064/80000]
tensor([0, 2, 0, 2, 0, 1, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 4, 0, 4, 0, 0, 0])
tensor([0, 2, 0, 2, 0, 1, 0, 2, 2, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,
        1, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 4, 0, 0, 2])
loss: 0.222263 [38464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.423291 [44864/80000]
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 1, 0, 0, 3, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 3, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 3, 1, 0, 0, 0, 0, 0, 0, 4,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
loss: 0.141312 [51264/80000]
tensor([0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 1, 4, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 4, 0, 0, 4, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 4])
tensor([0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 1, 4, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 4, 0, 0, 4, 0, 2, 0, 2,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 4])
loss: 0.254459 [57664/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4])
tensor([0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 4])
loss: 0.192010 [64064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 3, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0])
```

```
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0])
loss: 0.788579 [70464/80000]
tensor([1, 0, 0, 0, 0, 0, 3, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 1, 0,
        2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 2, 0])
tensor([0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 2, 0, 0, 2, 0, 2, 0, 0,
        0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0])
loss: 0.462512 [76864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 4, 0, 2, 0, 2, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 2, 0, 4, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 4, 2, 4, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 4, 4,
        0, 0, 4, 0, 2, 1, 2, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 2, 0, 4, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 4, 2, 4, 0])
loss: 0.186031 [83264/80000]
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 2, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 4, 0, 2, 4, 2, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 2, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 2, 0, 4, 0, 2, 4, 2, 0, 0, 0, 0, 0])
3591
Test Error:
Accuracy: 16.4%, Avg loss: 0.053826
```

Epoch 3

```
-----
loss: 0.262282 [ 64/80000]
tensor([0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 1, 4, 3, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 2, 2, 0, 4, 0])
tensor([0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 4, 3, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 2, 2, 0, 4, 0])
loss: 0.342103 [ 6464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 3, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.285553 [12864/80000]
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 2, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 1, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 2, 4, 1, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
loss: 0.353304 [19264/80000]
tensor([0, 2, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 4, 2, 0, 1, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0])
tensor([0, 1, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 4, 2, 0, 1, 0, 0, 0,
        0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0])
loss: 0.178210 [25664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
```

[illegible]

```
0, 0, 0, 2, 0, 0, 0, 2, 0, 1, 1, 0, 0, 2, 0, 0])
loss: 0.508407 [83264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 3, 0, 0, 0])
```

3576

Test Error:

Accuracy: 16.3%, Avg loss: 0.049115

Epoch 4

```
-----
loss: 0.107371 [ 64/80000]
tensor([1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])
loss: 0.219979 [ 6464/80000]
tensor([0, 2, 0, 0, 0, 0, 0, 1, 0, 2, 3, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 2, 0, 0, 1, 0, 0, 0, 0, 0, 0])
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 3, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 2, 0, 0, 1, 0, 0, 4, 0, 0, 0])
loss: 0.235826 [12864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 2, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 2, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 2, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 2, 0, 0, 4, 0, 0, 0, 4, 0, 1, 0, 0, 0])
loss: 0.339400 [19264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 1, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 3])
loss: 0.546969 [25664/80000]
tensor([1, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
loss: 0.094310 [32064/80000]
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0, 0, 2, 3, 0, 0, 0,
        0, 4, 0, 0, 4, 0, 2, 0, 0, 0, 4, 0, 0, 0, 2, 4, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 4, 0, 0, 4, 0, 2, 0, 0, 0, 4, 0, 0, 0, 2, 4, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.189158 [38464/80000]
tensor([2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 2, 0, 0, 4, 0, 0, 1, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```

```
tensor([2, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 2, 0, 0, 4, 0, 0, 1, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.318202 [44864/80000]
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 4, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0])
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 1, 0, 2, 0])
loss: 0.346262 [51264/80000]
tensor([4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 1, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0])
tensor([4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 3, 0, 0, 0, 0, 0, 2, 0, 0, 1, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0])
loss: 0.405570 [57664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 2, 0, 0, 4, 0, 0, 0, 4, 0,
        0, 0, 0, 2, 0, 4, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 1, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 2, 0, 0, 4, 0, 0, 0, 4, 0,
        0, 0, 0, 2, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0])
loss: 0.245943 [64064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 1, 4, 0, 0,
        4, 2, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 2, 4, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
tensor([0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0,
        4, 2, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 2, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
loss: 0.328439 [70464/80000]
tensor([3, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 4, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0])
tensor([2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 4, 4, 0, 0, 0, 0, 3,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 2, 0, 0, 0])
loss: 0.261177 [76864/80000]
tensor([0, 1, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 1, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 2, 0, 0,
        0, 4, 4, 0, 0, 0, 4, 0, 0, 0, 3, 0, 0, 0, 4, 0])
tensor([0, 1, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 2, 0, 0,
        0, 4, 4, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 4, 4])
loss: 0.075863 [83264/80000]
tensor([4, 0, 0, 2, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 1, 2, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])
tensor([4, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])
3632
Test Error:
  Accuracy: 16.6%, Avg loss: 0.042912
```

Epoch 5

-----  
loss: 0.444378 [ 64/80000]

```
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0, 0,
```

```
0, 2, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0,
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2])
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
4, 1, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0,
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2])
loss: 0.115464 [ 6464/80000]
tensor([0, 0, 0, 0, 0, 3, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 3, 0, 3, 4, 0, 0, 0, 1, 0, 2, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 4, 4, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 3, 4, 0, 0, 0, 1, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 4, 4, 0])
loss: 0.070304 [12864/80000]
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 2, 0, 4, 0, 2, 0, 0, 0, 0, 1, 0, 2, 0,
0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 2, 0, 4, 0, 2, 0, 0, 0, 0, 1, 0, 2, 0,
0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0])
loss: 0.290209 [19264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 1,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 3, 0, 0, 4, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 1,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0])
loss: 0.529801 [25664/80000]
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 1, 0,
0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 1])
loss: 0.115980 [32064/80000]
tensor([0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 4, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 4, 0, 0, 0,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 4, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 2, 2, 0, 0, 0, 4, 0, 0, 0,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1])
loss: 0.140915 [38464/80000]
tensor([0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 3, 0, 0, 0, 0,
0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0,
4, 2, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 3, 0, 0])
tensor([0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0,
4, 2, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0])
loss: 0.417640 [44864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
4, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 2, 4, 0, 0, 0, 0, 0, 0,
0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0,
4, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 2, 4, 0, 0, 0, 0, 0, 0,
1, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.469828 [51264/80000]
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 3, 0, 0, 4, 0, 2, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 3, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 4, 0, 0, 1,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 3, 0, 0, 4, 0, 2, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 2, 0, 0, 0, 3, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 4, 0, 0, 0,
0, 0, 0, 0, 0, 2, 0, 0, 0, 3, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 4, 0, 0, 0])
```

```
4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 3]))
loss: 0.427405 [57664/80000]
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 4, 2, 0, 0, 1, 2, 0, 0, 0, 0, 0, 0, 4, 0]))
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 4, 2, 1, 0, 1, 2, 0, 0, 0, 0, 0, 0, 4, 0]))
loss: 0.105262 [64064/80000]
tensor([0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0,
        0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0]))
tensor([0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 2, 0, 0, 0,
        0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0]))
loss: 0.090675 [70464/80000]
tensor([0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 2, 4, 0]))
tensor([0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0]))
loss: 0.057462 [76864/80000]
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 2, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0]))
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 2, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0]))
loss: 0.570119 [83264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0]))
tensor([0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0,
        0, 0, 2, 0, 2, 0, 2, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 3, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0]))
```

3661

Test Error:

Accuracy: 16.7%, Avg loss: 0.035645

Epoch 6

```
-----
loss: 0.100463 [ 64/80000]
tensor([0, 2, 0, 0, 0, 1, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0]))
tensor([0, 2, 0, 0, 0, 1, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0,
        2, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0]))
loss: 0.230055 [ 6464/80000]
tensor([0, 4, 0, 4, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 3, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 1, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0]))
tensor([0, 4, 0, 4, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 3, 0, 0,
        0, 0, 0, 4, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0,
        0, 0, 0, 1, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0]))
loss: 0.133174 [12864/80000]
tensor([0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]))
```



```
tensor([0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.103520 [19264/80000]
tensor([4, 2, 0, 4, 0, 0, 2, 0, 1, 4, 0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 3, 0, 0, 0, 0, 0])
tensor([4, 0, 0, 4, 0, 0, 2, 0, 1, 4, 0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0])
loss: 0.084734 [25664/80000]
tensor([0, 0, 4, 2, 0, 0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 2, 0,
        0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 2, 0, 0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 2, 0,
        0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.211597 [32064/80000]
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 4, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 1, 2, 0, 4, 2, 4, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 4, 0, 0, 0, 3, 0, 0, 4, 4, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 1, 2, 0, 4, 2, 4, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0])
loss: 0.265719 [38464/80000]
tensor([2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 4, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0])
tensor([2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 4, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0])
loss: 0.309320 [44864/80000]
tensor([2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 1, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
tensor([2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 1, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0])
loss: 0.181995 [51264/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 3, 2, 0, 3, 2,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 3, 2, 0, 3, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0])
loss: 0.204412 [57664/80000]
tensor([0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 1, 0, 0, 4])
tensor([0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0, 0, 2,
        0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 1, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 1, 0, 0, 4])
loss: 0.391059 [64064/80000]
tensor([0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 4, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0])
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 2, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 1, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 4, 0, 0, 0, 0, 4, 0, 3, 4, 0, 0, 0])
loss: 0.236173 [70464/80000]
```

```
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 2, 0,
        4, 2, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 2, 0,
        4, 2, 2, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0])
loss: 0.204737 [76864/80000]
tensor([0, 0, 2, 0, 0, 0, 0, 4, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 4, 0, 2, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 3,
        2, 1, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4])
tensor([0, 0, 2, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 4, 0, 2, 0, 2, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 3,
        2, 1, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4])
loss: 0.066354 [83264/80000]
tensor([0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0,
        0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0])
tensor([0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0,
        0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0])
```

3635

Test Error:

Accuracy: 16.6%, Avg loss: 0.041507

Epoch 7

```
-----
loss: 0.068335 [ 64/80000]
tensor([0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 3, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 4, 0, 2])
tensor([0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 4, 0, 2])
loss: 0.320296 [ 6464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.406396 [12864/80000]
tensor([0, 0, 0, 1, 0, 0, 0, 0, 4, 4, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 4, 0, 0, 2, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0])
tensor([0, 0, 0, 1, 0, 0, 0, 0, 4, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 4, 0, 0, 2, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1])
loss: 0.225790 [19264/80000]
tensor([0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 3, 0, 0, 0, 2, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0])
loss: 0.125839 [25664/80000]
tensor([0, 0, 0, 0, 4, 4, 4, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        1, 0, 0, 0, 0, 1, 4, 0, 2, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 4, 4, 4, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])
```

```
0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0])
loss: 0.208922 [32064/80000]
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 2, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0])
tensor([0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 4, 0, 4, 2, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0])
loss: 0.094308 [38464/80000]
tensor([0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
tensor([0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0])
loss: 0.199314 [44864/80000]
tensor([0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 4, 2, 0, 4,
0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 4, 0, 0, 0, 4, 0, 0, 3, 1, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 1, 0, 4, 4, 2, 0, 4,
0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 4, 0, 0, 0, 4, 0, 0, 3, 1, 0, 0, 0, 0, 0, 0])
loss: 0.199143 [51264/80000]
tensor([1, 2, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 0, 0, 2, 0, 0, 0, 3, 4, 4,
0, 0, 4, 0, 1, 2, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 1])
tensor([0, 2, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 0, 0, 2, 0, 0, 0, 2, 4, 4,
0, 0, 4, 0, 1, 2, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4,
0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 1])
loss: 0.190651 [57664/80000]
tensor([0, 0, 4, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 2, 0, 4, 4, 2, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 4, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 4, 2, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 4, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.062981 [64064/80000]
tensor([0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0])
loss: 0.226553 [70464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 0, 1, 4, 2, 0, 0,
0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0,
0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4])
loss: 0.173366 [76864/80000]
tensor([0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1,
2, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 0, 0, 2, 0, 1, 0, 4, 4, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 4, 4, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1,
2, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 0, 0, 2, 0, 1, 0, 4, 4, 0, 0, 0, 0, 0])
loss: 0.107970 [83264/80000]
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0])
```

```
4, 4, 0, 3, 0, 4, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        4, 4, 0, 2, 0, 4, 2, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0])
```

3666

Test Error:

Accuracy: 16.7%, Avg loss: 0.038474

Epoch 8

```
-----
loss: 0.248353 [ 64/80000]
tensor([0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 2, 2, 4, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0])
tensor([0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 1, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0])
loss: 0.138199 [ 6464/80000]
tensor([0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0,
        0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 2, 0, 0, 2, 0, 0,
        4, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0])
tensor([0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 4, 0, 2, 0, 0,
        0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 2, 0, 0, 2, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0])
loss: 0.421355 [12864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0,
        4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0])
loss: 0.098948 [19264/80000]
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.187081 [25664/80000]
tensor([0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 3, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 3, 0, 0, 4, 0, 4, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 3, 0, 0, 4, 0, 4, 0, 0, 0, 0])
loss: 0.267695 [32064/80000]
tensor([0, 3, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 1, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0])
tensor([2, 2, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 1, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0])
loss: 0.315455 [38464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 4, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 3, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 4, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 3, 3, 0, 1, 0])
loss: 0.440196 [44864/80000]
```

```
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 1, 4, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.214647 [51264/80000]
tensor([2, 0, 2, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 1, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 2, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 4, 1, 0, 1, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.032990 [57664/80000]
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.217574 [64064/80000]
tensor([0, 0, 4, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 3, 0, 0, 2, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 3, 0, 0, 2, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0])
loss: 0.167737 [70464/80000]
tensor([0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 1, 0,
        0, 2, 2, 0, 0, 0, 0, 0, 3, 4, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 3, 2,
        1, 0, 2, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0])
tensor([0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0,
        0, 2, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 3, 2,
        1, 0, 2, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0])
loss: 0.052667 [76864/80000]
tensor([1, 0, 2, 0, 0, 0, 0, 3, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 1, 0, 0, 4,
        0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([1, 0, 2, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 1, 0, 0, 4,
        0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.193155 [83264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 4, 0, 1, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 4, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0])
3656
Test Error:
Accuracy: 16.7%, Avg loss: 0.040902
```

Epoch 9

```
-----
loss: 0.474386 [ 64/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 2, 3, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0,
```

```
0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 3, 0, 0, 0, 0, 0]))
loss: 0.154666 [ 6464/80000]
tensor([4, 1, 0, 1, 2, 4, 4, 0, 0, 2, 4, 0, 2, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0, 2,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 2, 0, 4, 0, 0, 0, 4, 4, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0])
tensor([4, 1, 0, 1, 2, 4, 4, 0, 0, 2, 4, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 1, 0, 0, 0, 2, 0, 4, 0, 0, 0, 4, 4, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0])
loss: 0.186902 [12864/80000]
tensor([0, 4, 0, 0, 2, 0, 4, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 4, 0, 0, 2, 0, 4, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.362377 [19264/80000]
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0])
tensor([0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 1])
loss: 0.250440 [25664/80000]
tensor([0, 0, 0, 0, 0, 4, 0, 4, 1, 4, 0, 0, 0, 0, 0, 0, 4, 3, 0, 0, 1, 0, 0, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 4, 0, 4, 1, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 3, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.049385 [32064/80000]
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 3, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0,
        4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 4, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 3, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0,
        4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 4, 0, 0])
loss: 0.129852 [38464/80000]
tensor([0, 4, 0, 4, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0])
tensor([0, 4, 0, 4, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 4, 0,
        0, 0, 0, 0, 2, 0, 4, 0, 0, 2, 0, 0, 0, 4, 0, 0])
loss: 0.219436 [44864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0,
        0, 0, 0, 1, 4, 0, 0, 0, 4, 0, 2, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0])
loss: 0.089760 [51264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 1, 0, 0, 0, 2, 4, 0, 0, 2, 0, 0,
        0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 1, 0, 0, 0, 2, 4, 0, 4, 2, 0, 0,
        0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0])
loss: 0.252076 [57664/80000]
tensor([3, 0, 0, 0, 0, 1, 2, 0, 0, 1, 0, 0, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4,
```

```
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 1, 2, 0, 0, 1, 0, 0, 0, 2, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0])
loss: 0.266872 [64064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0])
loss: 0.076198 [70464/80000]
tensor([0, 1, 0, 0, 0, 0, 4, 0, 2, 0, 0, 1, 2, 0, 4, 0, 3, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
tensor([0, 1, 0, 0, 0, 0, 4, 0, 2, 0, 0, 1, 2, 0, 4, 0, 3, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 4, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
loss: 0.171631 [76864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 4, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 3, 4, 0, 0, 4, 2, 0, 4])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 4, 0, 0, 4, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 3, 4, 0, 0, 4, 0, 0, 4])
loss: 0.380169 [83264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        1, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0])
tensor([3, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        1, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0])
3640
Test Error:
Accuracy: 16.6%, Avg loss: 0.037110
```

Epoch 10

```
-----
loss: 0.131908 [ 64/80000]
tensor([0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2])
tensor([2, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0])
loss: 0.229182 [ 6464/80000]
tensor([0, 0, 0, 0, 0, 4, 0, 0, 1, 0, 0, 4, 2, 0, 1, 4, 0, 0, 1, 0, 3, 0, 4, 0,
        1, 0, 0, 0, 1, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 4, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 4, 0, 1, 0])
tensor([0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 0,
        0, 4, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 0])
loss: 0.231136 [12864/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 2, 0, 1, 0, 3, 4, 2, 4, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 0, 3, 4, 3, 4, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.057918 [19264/80000]
```

```
tensor([0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0])
loss: 0.258503 [25664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 2, 2, 0, 0, 0, 0])
tensor([0, 0, 0, 2, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 4, 2, 2, 2, 0, 0, 0, 0])
loss: 0.092751 [32064/80000]
tensor([4, 3, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 4, 4, 0, 0, 0, 0,
        0, 0, 4, 2, 0, 0, 2, 0, 0, 0, 2, 0, 0, 3, 0, 0])
tensor([4, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 4, 4, 0, 0, 0, 0,
        0, 0, 4, 2, 0, 0, 2, 0, 0, 0, 2, 0, 0, 3, 0, 0])
loss: 0.198094 [38464/80000]
tensor([0, 0, 1, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        1, 0, 0, 0, 3, 0, 4, 2, 1, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 1, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
        0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        1, 0, 0, 0, 3, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.420109 [44864/80000]
tensor([0, 0, 2, 0, 2, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 3, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.236368 [51264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 2, 2, 0, 1, 2, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
        0, 2, 2, 0, 0, 2, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 4, 1, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.295138 [57664/80000]
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 1, 4, 0, 0, 4, 0, 0, 2,
        2, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 2, 0, 3, 0, 2, 2, 0, 4, 0, 0, 0, 0, 1, 0, 0])
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 1, 4, 0, 0, 4, 0, 0, 1,
        2, 0, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 2, 0, 3, 0, 2, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0])
loss: 0.108661 [64064/80000]
tensor([0, 0, 0, 0, 0, 1, 0, 0, 0, 4, 0, 0, 3, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 1, 0, 0, 0, 4, 0, 0, 3, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0, 0, 0, 0])
loss: 0.068407 [70464/80000]
tensor([2, 0, 2, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0])
tensor([2, 0, 2, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
```



```
0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0])
loss: 0.085965 [76864/80000]
tensor([0, 4, 1, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 2, 0])
tensor([0, 4, 1, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0])
loss: 0.175640 [83264/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 4])
tensor([0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 0,
0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4])
3630
Test Error:
Accuracy: 16.6%, Avg loss: 0.036623
```

Epoch 11

```
-----
loss: 0.142777 [ 64/80000]
tensor([0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 1, 3, 0, 0, 0, 2, 0, 0, 3, 0, 0, 0, 0, 0,
0, 1, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 1, 0, 0, 0,
2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 2, 0, 2, 0, 0, 2, 1, 3, 0, 0, 0, 2, 0, 0, 3, 0, 0, 0, 0, 0,
0, 1, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0,
2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0])
loss: 0.606964 [ 6464/80000]
tensor([0, 0, 0, 4, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 1, 0, 0, 1, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 1, 0])
tensor([0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 0, 3, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1,
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0])
loss: 0.178337 [12864/80000]
tensor([0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2,
0, 0, 0, 4, 0, 0, 0, 4, 0, 4, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
1, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 4])
tensor([0, 2, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2,
0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 4])
loss: 0.326126 [19264/80000]
tensor([0, 4, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 1, 4, 0, 0, 3, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 3, 0, 0, 4, 0, 0, 0, 0, 3, 0, 0, 2,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 4, 2, 0, 2, 0, 0, 0, 1, 0, 0, 0, 4, 0, 0, 0, 1, 4, 0, 0, 3, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 3, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 2,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.147463 [25664/80000]
tensor([1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 1, 0, 2,
0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0])
tensor([1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 1, 0, 2,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0])
loss: 0.126398 [32064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0,
2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```

```

0, 4, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.396998 [38464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 3, 0])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 2, 0, 3, 0])
loss: 0.295381 [44864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 1, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 4, 2])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 2])
loss: 0.282345 [51264/80000]
tensor([0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 1, 0, 0])
tensor([0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 1, 0, 0])
loss: 0.271960 [57664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0,
        0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.367834 [64064/80000]
tensor([0, 4, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 2, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0, 4])
tensor([0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 2, 0, 2, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0, 4])
loss: 0.229360 [70464/80000]
tensor([0, 0, 4, 2, 0, 0, 4, 1, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0])
tensor([0, 0, 4, 2, 0, 0, 4, 1, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 1])
loss: 0.297733 [76864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 2, 0, 0, 2, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 0, 2, 4, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0])
loss: 0.220938 [83264/80000]
tensor([0, 0, 4, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 1, 4,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 4, 0, 0, 0, 0, 4, 0, 0, 1, 0, 0, 0, 0, 4, 4, 0, 0, 0, 1, 4,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0])

```

3645

Test Error:

Accuracy: 16.6%, Avg loss: 0.033692

Epoch 12

-----  
loss: 0.185873 [ 64/80000]tensor([0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0,  
0, 0, 1, 0, 0, 0, 2, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 4, 0, 0, 2])tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0,  
0, 0, 1, 0, 0, 0, 2, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 4, 0, 0, 2])

loss: 0.065736 [ 6464/80000]

tensor([0, 0, 0, 0, 0, 0, 0, 2, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 0, 4, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])tensor([0, 0, 0, 0, 0, 0, 0, 2, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])

loss: 0.085735 [12864/80000]

tensor([0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 4, 0, 4, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0,  
0, 0, 0, 0, 1, 2, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0])tensor([0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 4, 0, 4, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0,  
0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0])

loss: 0.379902 [19264/80000]

tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 2, 0, 0, 0, 0, 4, 0, 0, 4, 2,  
0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 2,  
0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 1, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])

loss: 0.190079 [25664/80000]

tensor([0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0,  
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 2, 0, 0, 0, 1, 2, 1, 0, 0, 1, 0, 0])tensor([0, 4, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0,  
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 2, 0, 0, 0, 1, 2, 1, 0, 0, 0, 0, 0])

loss: 0.104829 [32064/80000]

tensor([0, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0,  
0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,  
4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])tensor([0, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 1, 0,  
0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,  
4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])

loss: 0.058909 [38464/80000]

tensor([2, 2, 2, 2, 0, 2, 0, 0, 4, 0, 2, 0, 0, 0, 2, 1, 0, 0, 0, 0, 0, 0, 2, 0,  
0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 2, 0,  
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0])tensor([2, 2, 2, 2, 0, 2, 0, 0, 4, 0, 2, 0, 0, 0, 2, 1, 0, 0, 0, 0, 0, 0, 2, 0,  
0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 2, 0,  
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0])

loss: 0.227885 [44864/80000]

tensor([0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 4, 0, 0, 0, 0, 0, 0,  
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 1, 0, 4, 0, 0, 4, 0, 0, 0, 0,  
2, 2, 0, 0, 1, 4, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0])

tensor([0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 4, 0, 0, 0, 0, 0, 0,

```

0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 1, 0, 0, 0, 0, 4, 0, 0, 0,
2, 0, 0, 0, 0, 4, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0])
loss: 0.077610 [51264/80000]
tensor([4, 0, 2, 0, 0, 0, 0, 0, 0, 4, 4, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0,
0, 2, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 2])
tensor([4, 0, 2, 0, 0, 0, 0, 0, 0, 4, 4, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0,
0, 2, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2])
loss: 0.125087 [57664/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 4, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0,
4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 3, 0, 0, 1, 0, 1, 2, 0, 4, 4, 1,
0, 1, 0, 0, 1, 0, 4, 0, 0, 0, 4, 2, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0,
4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 3, 0, 0, 1, 0, 1, 2, 0, 0, 4, 1,
0, 1, 0, 0, 0, 4, 0, 0, 0, 4, 2, 0, 0, 0, 0])
loss: 0.381721 [64064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 4,
0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 1, 2, 0, 4,
0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 2, 0, 0])
loss: 0.232264 [70464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0])
loss: 0.330641 [76864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1,
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 1, 0, 1, 4, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.115293 [83264/80000]
tensor([0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 2])
tensor([0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 2])
3626
Test Error:
Accuracy: 16.6%, Avg loss: 0.040534

```

Epoch 13

```
loss: 0.345785 [ 64/80000]
tensor([0, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 1, 2, 0, 0, 2, 4, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0])
tensor([3, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 1, 2, 0, 0, 2, 4, 0,
        0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0])
loss: 0.169059 [ 6464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0,
        1, 4, 3, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
```

```
0, 0, 2, 0, 0, 2, 0, 4, 0, 0, 0, 0, 2, 0, 0, 4]))
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0,
        1, 4, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
        0, 0, 2, 0, 0, 2, 0, 4, 0, 0, 0, 0, 2, 0, 0, 4]))
loss: 0.100142 [12864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.298037 [19264/80000]
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 4, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 2, 1, 0, 0, 2, 0, 1, 0, 2, 0, 0, 0, 0, 0, 0])
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 2, 0, 1, 0, 2, 0, 0, 0, 0, 2, 0])
loss: 0.420083 [25664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 2, 0, 2, 0, 3, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 2, 0, 2, 0, 3, 0, 0, 0, 0, 4, 4, 2, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.169674 [32064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 3, 0, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 2, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 3, 0, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.549060 [38464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 1, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.133636 [44864/80000]
tensor([0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 1, 2, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0])
tensor([0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 1, 2, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2])
loss: 0.343205 [51264/80000]
tensor([0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 2, 2, 2,
        4, 0, 0, 0, 0, 0, 4, 0, 0, 1, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 1, 0, 0, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 2, 4, 0, 0, 0, 0, 0, 2, 2, 2,
        4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0])
loss: 0.073896 [57664/80000]
tensor([0, 0, 0, 0, 0, 0, 4, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 4, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0])
```

```
loss: 0.395967 [64064/80000]
tensor([0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 4, 4, 0, 0, 4, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])
tensor([0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 2, 0, 2, 4, 4, 0, 0, 4, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0])
loss: 0.496181 [70464/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 4,
        0, 0, 0, 0, 4, 2, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 2])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4,
        0, 0, 1, 0, 4, 2, 0, 0, 0, 4, 0, 0, 0, 0, 1, 4, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 2])
loss: 0.363962 [76864/80000]
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0])
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0])
loss: 0.084032 [83264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0,
        1, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 0, 4, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
        1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0])
3622
Test Error:
Accuracy: 16.5%, Avg loss: 0.032952
```

Epoch 14

```
-----
loss: 0.103211 [ 64/80000]
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 4, 4, 0, 4, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 3, 0, 1, 0, 0, 0, 0, 0, 4, 2, 1, 0,
        1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0])
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 4, 0, 4, 4,
        0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 3, 0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0])
loss: 0.636880 [ 6464/80000]
tensor([0, 0, 0, 0, 1, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 4, 2, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 1, 4, 0, 0, 0, 0, 3, 2, 0, 0, 0, 0, 0, 0, 2, 4, 2, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.162740 [12864/80000]
tensor([0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 0, 3, 0, 0, 2, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0])
tensor([0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 0, 3, 0, 0, 2, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0,
        1, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0])
loss: 0.322971 [19264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        4, 0, 0, 0, 4, 0, 0, 4, 2, 4, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 1, 0, 0, 0, 2, 0, 0, 0,
```

```
4, 0, 0, 0, 4, 0, 2, 4, 2, 4, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.193445 [25664/80000]
tensor([0, 4, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2])
tensor([0, 4, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2])
loss: 0.142539 [32064/80000]
tensor([0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 1, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 1, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.148018 [38464/80000]
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.177529 [44864/80000]
tensor([0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2])
tensor([0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2])
loss: 0.093335 [51264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 2, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2,
0, 0, 0, 4, 2, 0, 0, 0, 1, 0, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
0, 0, 0, 4, 2, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0])
loss: 0.318848 [57664/80000]
tensor([0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
2, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 1,
2, 0, 0, 0, 1, 0, 0, 0, 4, 0, 0, 4, 2, 0, 0, 0])
tensor([0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
2, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0,
2, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 4, 2, 0, 0, 0])
loss: 0.127202 [64064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 4, 0, 0, 1, 0, 0, 0, 0, 0, 4,
0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 2, 4, 0, 0, 1, 0, 0, 0, 0, 0, 4,
0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.058581 [70464/80000]
tensor([0, 0, 0, 0, 0, 4, 0, 2, 0, 4, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 4, 0, 1, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
0, 3, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 4])
tensor([0, 0, 0, 0, 0, 4, 0, 2, 0, 4, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 4, 0, 1, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 3, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 4])
loss: 0.207234 [76864/80000]
tensor([4, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0,
```

```
0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([4, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0,
0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
0, 0, 0, 4, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.075251 [83264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 4, 0, 0, 0, 4, 0, 2, 0,
0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 2, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 4, 0, 0, 0, 2, 0, 2, 0,
0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 2, 0, 0])
```

3623

Test Error:

Accuracy: 16.5%, Avg loss: 0.034547

Epoch 15

```
-----
loss: 0.104080 [ 64/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 4, 0, 0, 2, 1, 2, 0, 0, 0, 2, 2, 2, 0, 0, 0, 0, 0, 0, 4, 0,
1, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 4, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 4, 0, 0, 2, 0, 2, 0, 0, 0, 2, 2, 2, 0, 0, 0, 0, 0, 0, 4, 0,
1, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0])
loss: 0.053266 [ 6464/80000]
tensor([0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 4, 0,
0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0,
4, 0, 4, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 4, 0,
0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,
4, 0, 4, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.107921 [12864/80000]
tensor([4, 0, 1, 0, 0, 0, 4, 0, 4, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
0, 0, 0, 2, 0, 2, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2])
tensor([4, 0, 1, 0, 0, 0, 4, 0, 4, 2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
0, 0, 0, 2, 0, 2, 1, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2,
0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2])
loss: 0.182848 [19264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 4, 0, 0, 0, 0,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 1, 0, 0, 3, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 0, 4, 2, 0, 0, 0,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 1, 0, 0, 3, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.103553 [25664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 3, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4,
0, 1, 0, 2, 0, 0, 2, 0, 0, 0, 0, 4, 0, 4, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 0,
0, 0, 1, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4,
0, 1, 0, 2, 0, 0, 2, 0, 0, 0, 0, 4, 0, 4, 0, 0])
loss: 0.159484 [32064/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 2, 0, 4, 0, 0, 0, 0, 2, 2, 2, 0, 0, 0, 0,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 2, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 2, 0, 4, 0, 0, 0, 0, 2, 2, 2, 0, 0, 0, 0,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 2, 0, 0, 0, 0,
0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0])
```



```
loss: 0.118060 [38464/80000]
tensor([0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0,
        0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 4, 0, 0,
        0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0])
loss: 0.307650 [44864/80000]
tensor([2, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 4, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([2, 0, 0, 0, 0, 0, 2, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0,
        0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 4, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 1])
loss: 0.475634 [51264/80000]
tensor([0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 4, 2, 4, 0, 0,
        1, 0, 0, 0, 1, 0, 4, 0, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0,
        0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 4, 2, 4, 0, 0,
        0, 0, 0, 0, 1, 0, 4, 4, 2, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 0,
        0, 0, 0, 1, 0, 0, 0, 0, 2, 3, 0, 0, 0, 0, 1, 0])
loss: 0.263050 [57664/80000]
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 4, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0])
tensor([0, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 4, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0])
loss: 0.095850 [64064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 1, 0, 0, 2, 0, 2,
        0, 2, 4, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 2, 0, 0, 0, 4, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 1, 0, 0, 2, 0, 2,
        0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.043833 [70464/80000]
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 2, 0, 4, 2, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0])
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 2, 0, 4, 2, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0])
loss: 0.240691 [76864/80000]
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 1, 4, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 2, 2, 0, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 4, 0, 0, 1, 4, 0, 0, 0, 0, 0, 4, 0, 1, 4, 0, 0, 0, 0,
        0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 2, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0])
loss: 0.109227 [83264/80000]
tensor([0, 0, 3, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 3, 0, 0, 0, 2, 3, 0, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0])
tensor([0, 0, 3, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 3, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0])
```

3650

Test Error:

Accuracy: 16.7%, Avg loss: 0.028529

Epoch 16

```
-----
loss: 0.162263 [ 64/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 4, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0])
tensor([0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 4, 0, 0, 0, 4, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0])
loss: 0.114979 [ 6464/80000]
tensor([1, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 2, 0,
        2, 0, 4, 0, 2, 0, 0, 2, 1, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 4, 4, 0,
        1, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 4, 0, 0])
tensor([1, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0,
        2, 0, 4, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 4, 0,
        1, 1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 4, 0, 0])
loss: 0.350803 [12864/80000]
tensor([0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 2, 0, 2, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 2, 0, 4, 2, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0])
tensor([0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 2, 0, 2, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 2, 0, 4, 2, 0,
        0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 1, 0, 3])
loss: 0.330434 [19264/80000]
tensor([0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 2, 0, 2, 0, 1, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0])
tensor([0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 2, 0, 2, 0, 0, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0])
loss: 0.042395 [25664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0,
        0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0,
        0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.201807 [32064/80000]
tensor([0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 3, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        1, 0, 4, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4])
tensor([0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 3, 2, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        1, 0, 4, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4])
loss: 0.054344 [38464/80000]
tensor([0, 2, 0, 0, 0, 2, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4,
        2, 0, 0, 0, 2, 0, 0, 4, 0, 4, 0, 0, 2, 0, 0, 0])
tensor([0, 2, 0, 0, 0, 2, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0,
        0, 2, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4,
        2, 0, 0, 0, 2, 0, 0, 4, 0, 4, 0, 0, 2, 0, 0, 0])
loss: 0.142882 [44864/80000]
tensor([2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        1, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 2, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.046815 [51264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
```

```
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 3,
0, 1, 0, 4, 2, 0, 0, 2, 4, 0, 0, 0, 0, 2, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 1, 0,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 3,
0, 1, 0, 4, 2, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0])
loss: 0.138169 [57664/80000]
tensor([0, 0, 0, 2, 0, 4, 4, 4, 2, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2,
0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0,
0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0])
tensor([0, 0, 0, 2, 0, 4, 4, 4, 2, 0, 0, 0, 1, 2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2,
0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0,
0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0])
loss: 0.295735 [64064/80000]
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0,
0, 4, 4, 0, 0, 2, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 0, 4, 0])
tensor([0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0,
0, 4, 1, 0, 0, 2, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
0, 0, 1, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 0, 4, 0])
loss: 0.156083 [70464/80000]
tensor([0, 4, 2, 0, 0, 1, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0,
4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0])
tensor([0, 4, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 2, 0,
2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0])
loss: 0.203156 [76864/80000]
tensor([0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 2])
tensor([0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 3, 4, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 2])
loss: 0.113541 [83264/80000]
tensor([4, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 2, 2, 0, 0, 0,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 2, 1, 0, 0, 4, 0, 2,
0, 1, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0])
tensor([4, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 2, 2, 0, 0, 0,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 2, 1, 0, 0, 4, 0, 2,
0, 1, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0])
```

3657

Test Error:

Accuracy: 16.7%, Avg loss: 0.037323

Epoch 17

-----

```
loss: 0.094278 [ 64/80000]
tensor([4, 1, 4, 0, 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 1, 1, 0, 0, 0, 0,
0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0])
tensor([4, 1, 4, 0, 2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 1, 0, 0, 0, 0, 0,
0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0])
loss: 0.068535 [ 6464/80000]
tensor([2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,
0, 2, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4,
0, 0, 0, 4, 0, 0, 3, 1, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 1, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,
0, 2, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0, 4,
0, 0, 0, 4, 0, 0, 3, 1, 0, 0, 0, 0, 0, 0, 0, 0])
```

```
loss: 0.121584 [12864/80000]
tensor([4, 2, 0, 2, 2, 0, 0, 0, 1, 2, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 1, 0, 0, 0])
tensor([4, 2, 0, 2, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0])
loss: 0.094307 [19264/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4,
        0, 0, 0, 0, 0, 4, 0, 3, 0, 0, 0, 3, 4, 0, 0, 1])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0,
        0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4,
        0, 0, 0, 0, 0, 4, 0, 3, 0, 0, 0, 3, 4, 0, 0, 1])
loss: 0.371334 [25664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 4, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 2, 0, 4, 0, 0, 2, 0, 0, 4, 4, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 0, 0, 0, 4, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0,
        0, 0, 0, 2, 0, 4, 0, 0, 2, 0, 0, 4, 4, 0, 0, 0])
loss: 0.076970 [32064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 4, 0,
        2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 4, 0,
        2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0])
loss: 0.035275 [38464/80000]
tensor([0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 2, 2, 0, 0, 0, 0, 0, 0, 2, 0])
tensor([0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 2, 2, 0, 0, 0, 0, 0, 0, 2, 0])
loss: 0.085134 [44864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 1, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        1, 1, 0, 4, 0, 0, 0, 4, 0, 0, 2, 0, 2, 0, 4, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 1, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
        0, 0, 0, 4, 0, 0, 0, 2, 0, 0, 2, 0, 2, 0, 4, 0])
loss: 0.062737 [51264/80000]
tensor([0, 4, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        0, 1, 0, 0, 0, 0, 0, 0, 4, 4, 0, 3, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0,
        2, 1, 0, 0, 0, 0, 4, 4, 4, 0, 0, 0, 4, 0, 0])
tensor([0, 4, 0, 0, 0, 2, 4, 0, 0, 0, 2, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        0, 1, 0, 0, 0, 0, 0, 0, 4, 4, 0, 3, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0,
        2, 1, 0, 0, 0, 0, 4, 4, 4, 0, 0, 0, 4, 0, 0])
loss: 0.233107 [57664/80000]
tensor([0, 4, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 4, 0, 2, 0, 2, 0, 0, 2, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 4, 2, 0, 0, 0, 4, 2, 0, 4, 0, 0])
tensor([0, 4, 0, 0, 4, 1, 0, 0, 0, 2, 0, 0, 0, 0, 4, 1, 2, 0, 2, 0, 0, 2, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 4, 2, 0, 0, 0, 4, 2, 0, 4, 0, 0])
loss: 0.052354 [64064/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 3, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 4, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        2, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0])
```

Epoch 18

127.0.0.1:18020/lab/tree/DL/0713ECG.ipynb

```
0, 0, 1, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 0, 2,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0])
tensor([0, 4, 2, 0, 0, 0, 0, 0, 0, 2, 3, 0, 3, 0, 0, 0, 4, 0, 0, 0, 1, 2, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 0, 2,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0])
loss: 0.094093 [32064/80000]
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 2, 1, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 2, 1, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.062199 [38464/80000]
tensor([1, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 2, 1, 4, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0])
tensor([1, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 1, 4, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0])
loss: 0.097855 [44864/80000]
tensor([2, 0, 4, 4, 0, 0, 1, 0, 1, 0, 1, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0,
0, 3, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([2, 0, 4, 4, 0, 0, 0, 0, 1, 0, 1, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0,
0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.167037 [51264/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 2, 4, 0, 0, 2, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2,
0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 4, 4, 2, 4, 0, 0, 2, 0, 3, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2,
0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0])
loss: 0.149420 [57664/80000]
tensor([0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
4, 0, 0, 0, 0, 0, 4, 1, 4, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
4, 0, 0, 0, 0, 0, 4, 1, 4, 0, 0, 0, 0, 0, 0, 0])
loss: 0.078123 [64064/80000]
tensor([0, 4, 3, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 4, 0, 0, 0, 1, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 1, 0, 0, 0, 4, 0, 2, 0, 0, 1, 0])
tensor([0, 4, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 4, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 1, 0, 0, 0, 4, 0, 2, 0, 0, 1, 0])
loss: 0.216120 [70464/80000]
tensor([0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 3, 0, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 3, 0, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 0, 3, 0, 1, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.167805 [76864/80000]
tensor([0, 0, 4, 4, 2, 0, 0, 2, 0, 0, 0, 4, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 3])
tensor([0, 0, 4, 4, 2, 0, 0, 2, 0, 0, 0, 4, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4,
```

```
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3]))
loss: 0.034160 [83264/80000]
tensor([0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 4, 1, 0, 1, 0, 0, 0, 0, 4, 4, 4, 4,
        4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 4])
tensor([0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 4, 1, 0, 1, 0, 0, 0, 0, 4, 4, 4, 4,
        4, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 2, 2, 0, 0, 0, 4, 0, 0, 0, 0, 0, 4, 0, 4])
```

3670

Test Error:

Accuracy: 16.8%, Avg loss: 0.031790

Epoch 19

```
-----
loss: 0.127465 [ 64/80000]
tensor([0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 1, 2, 0, 0, 0, 1, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 4, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0])
loss: 0.287613 [ 6464/80000]
tensor([0, 2, 4, 0, 4, 0, 4, 0, 1, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0,
        0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 2, 2, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 2, 0,
        0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0,
        0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0])
loss: 0.019979 [12864/80000]
tensor([0, 4, 0, 4, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 2, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 4, 0, 4, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 2, 0,
        0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.265845 [19264/80000]
tensor([0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 4, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 2, 0, 0, 4, 0, 0, 0, 4, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0])
loss: 0.275657 [25664/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 4, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        2, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 2, 4, 0, 0])
loss: 0.178327 [32064/80000]
tensor([0, 0, 4, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 0, 0, 2, 0, 0, 0, 4, 0, 0, 0, 2])
tensor([0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 0, 4, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 4,
        0, 0, 1, 0, 0, 0, 2, 0, 0, 0, 4, 0, 2, 0, 0, 2])
loss: 0.055242 [38464/80000]
tensor([0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 3, 0, 0, 4, 0, 0, 0, 0, 0, 1, 0, 4,
        2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```

```
tensor([0, 0, 4, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
```



```
0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 4, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0,
0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0,
0, 0, 0, 2, 0, 2, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0])
loss: 0.133254 [ 6464/80000]
tensor([0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0,
0, 0, 0, 0, 0, 2, 0, 0, 0, 1, 4, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0,
0, 0, 0, 1, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0])
tensor([0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 1, 0, 4, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0])
loss: 0.174055 [12864/80000]
tensor([0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2,
0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 2,
0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0])
tensor([0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 4, 0,
0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0])
loss: 0.088542 [19264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 2, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 2, 4,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 3, 4, 0, 0, 0,
2, 2, 0, 0, 1, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 2, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 2, 4,
0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 3, 4, 0, 0, 0,
2, 2, 0, 0, 1, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0])
loss: 0.063225 [25664/80000]
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 2, 0, 2, 0, 0,
0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 4, 0, 2, 0, 0, 0])
tensor([0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 2, 0, 2, 0, 0,
0, 0, 0, 0, 0, 0, 0, 1, 2, 0, 4, 0, 2, 0, 0, 0])
loss: 0.231213 [32064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 2, 0, 3, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 2, 4, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 2, 4, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0])
loss: 0.068834 [38464/80000]
tensor([0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0,
2, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0])
tensor([0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0,
2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0,
0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 4, 0, 0, 0])
loss: 0.084247 [44864/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0,
0, 0, 0, 2, 0, 4, 0, 0, 0, 4, 0, 0, 0, 2, 4, 0, 0, 0, 0, 1, 0, 2, 0, 0,
0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 2, 0, 0, 0,
0, 0, 0, 2, 0, 4, 0, 0, 0, 4, 0, 0, 0, 2, 4, 0, 0, 0, 0, 2, 0, 2, 0, 0,
0, 0, 4, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0])
loss: 0.180432 [51264/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
1, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0,
0, 0, 2, 0, 0, 0, 1, 4, 0, 0, 0, 2, 0, 1, 0, 4])
tensor([0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 1, 4, 4, 1, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0,
0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0])
```

```

    0, 0, 2, 0, 0, 0, 1, 4, 0, 0, 0, 2, 0, 1, 0, 4])
loss: 0.148122 [57664/80000]
tensor([0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 1, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 3, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 4, 0, 0, 0,
        4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 3, 0, 0, 0, 0, 0, 2, 0, 0, 2, 0, 0, 0])
loss: 0.262482 [64064/80000]
tensor([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 1, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 1, 0, 0, 2, 0, 2, 0, 4])
tensor([0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 2, 0, 4, 0,
        0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 4])
loss: 0.227234 [70464/80000]
tensor([2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([2, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 0, 4])
loss: 0.051801 [76864/80000]
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0, 0, 4, 0,
        1, 2, 0, 0, 0, 4, 4, 0, 0, 4, 0, 0, 0, 0, 1, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0])
tensor([4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 4, 0, 4, 0, 0, 0, 0, 4, 0,
        1, 2, 0, 0, 0, 4, 4, 0, 0, 4, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0])
loss: 0.147650 [83264/80000]
tensor([0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 0, 0, 4, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0,
        4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
tensor([0, 0, 0, 0, 0, 4, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
        0, 0, 2, 0, 0, 2, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 2, 0, 2, 0, 0, 0, 0,
        4, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
3636
Test Error:
Accuracy: 16.6%, Avg loss: 0.033541

```

Done!

```

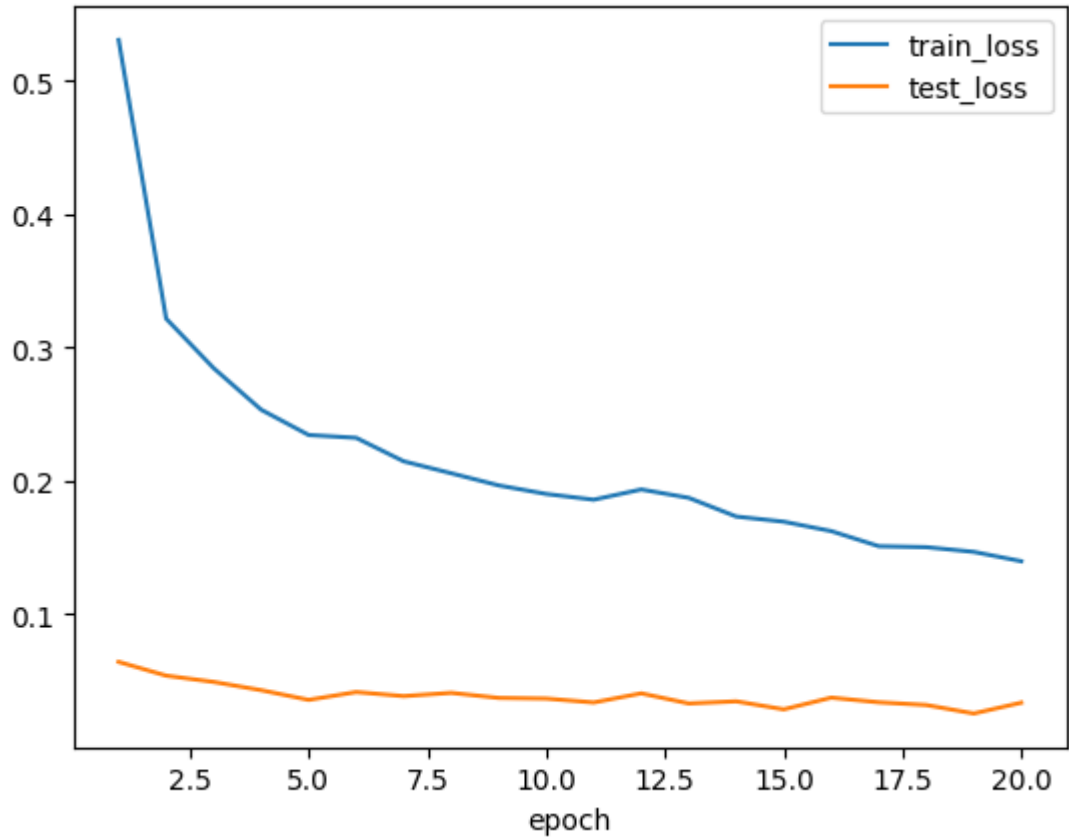
In [21]: print(history)
plt.plot(range(1, epochs+1), history['train_loss'], label='train_loss')
plt.plot(range(1, epochs+1), history['test_loss'], label='test_loss')
plt.xlabel('epoch')
plt.legend()

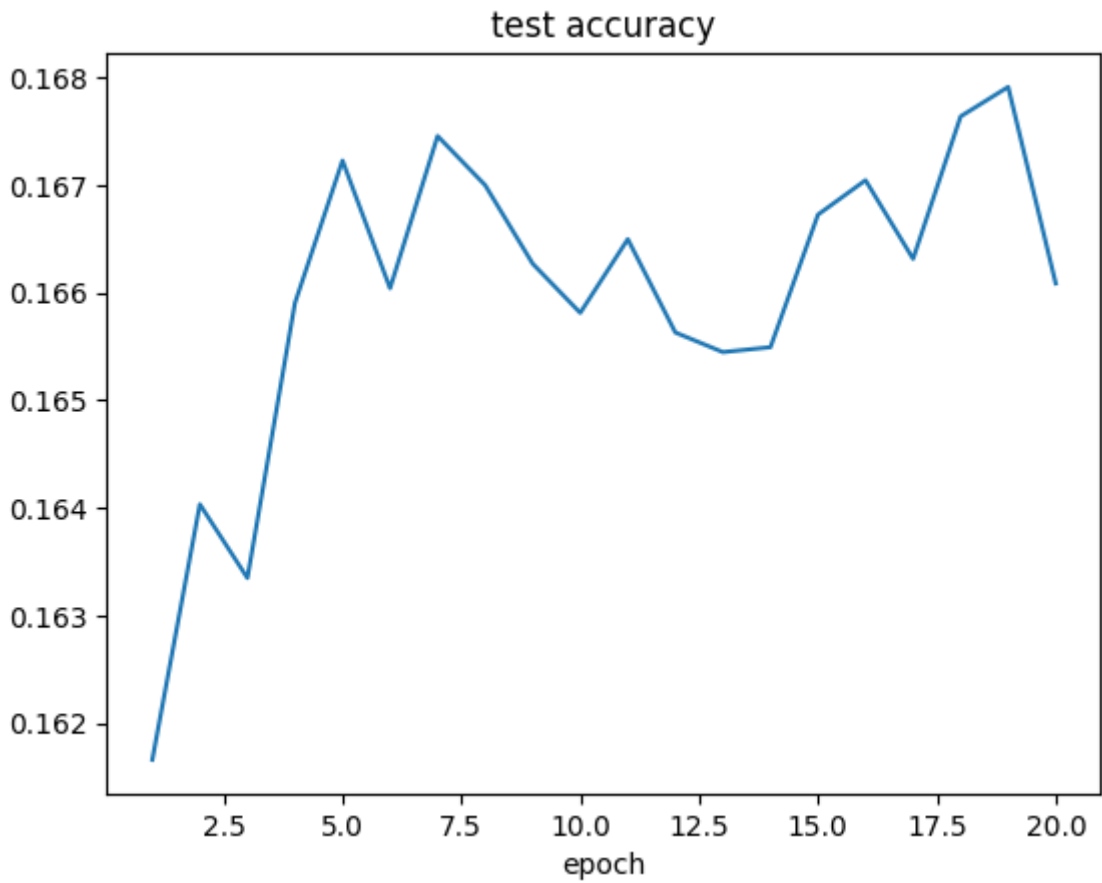
plt.figure()
plt.plot(range(1, epochs+1), history['test_acc'])
plt.title('test accuracy')
plt.xlabel('epoch')

```

```
{'train_loss': [0.5308029985911137, 0.3216990112409355, 0.28455389697319666, 0.25336981941371, 0.23438195435777906, 0.2322727548240135, 0.21465412407591014, 0.20568950364598834, 0.19657827054821853, 0.19015895662906834, 0.18584477035444397, 0.1935303009396121, 0.1872496150755116, 0.17322537860948078, 0.16934989701134714, 0.16228636511083805, 0.1509623181093906, 0.15024899849919854, 0.14670137731784272, 0.13969129680297382], 'test_loss': [0.06415403951448184, 0.053826417502439404, 0.049114859073745964, 0.042912308941255854, 0.03564461128400644, 0.04150685421992148, 0.03847400404773544, 0.040901784027543776, 0.03710982831243871, 0.036623249856793154, 0.033692092561426384, 0.040533562595399406, 0.03295249040116374, 0.03454711185035136, 0.02852878161317753, 0.03732287304872327, 0.033830869818003116, 0.0317895008528024, 0.025422094520127114, 0.03354065767530102], 'test_acc': [0.16165722638406724, 0.16403252329618126, 0.16334734149460992, 0.16590535355380961, 0.16723003837018088, 0.16604238991412387, 0.167458432304038, 0.16700164443632376, 0.166270783847981, 0.16581399598026678, 0.16649917778183812, 0.16563128083318107, 0.16544856568609537, 0.1654942444728668, 0.16672757171569524, 0.1670473232230952, 0.16631646263475242, 0.16764114745112368, 0.16791522017175223, 0.1660880687008953]}
```

```
Out[21]: Text(0.5, 0, 'epoch')
```





```
In [ ]:
```