In [62]:
```
import numpy as np
import matplotlib.pyplot as plt
import torch
import torch.nn as nn
import torch.nn.functional as F
import torch.nn.init as init
import os, glob
from datetime import datetime
import pandas as pd
from torch.utils.data import Dataset, DataLoader
```

## Question 2

CNN training: Train a Convolutional Neural Network on the simulated data for each of the nine simulation settings. The goal is to use the CNN to predict the cancer status $yi$ based on the simulated images $Xi$ . Additionally, generate a test set of 1000 subjects using the same data generation process and evaluate the CNN's performance in terms of classification accuracy. You are free to build a CNN with arbitrary hyperparameter setting. Conduct at least 10 independent experiments for each setting by generating new datasets each time, and report the hyperparameters for the CNN, the mean and standard deviation of the classification accuracy achieved by your CNN model.

### MODEL 2

In [46]:
```
model2 = torch.nn.Sequential()
model2.add_module('conv1', torch.nn.Conv2d(in_channels=1, out_channels=2, kernel_size
model2.add_module('relu1', torch.nn.ReLU())
model2.add_module('pool1', torch.nn.MaxPool2d(kernel_size = 2))


model2.add_module('conv2', torch.nn.Conv2d(in_channels=2, out_channels=4, kernel_size
model2.add_module('relu2', torch.nn.ReLU())
model2.add_module('pool2', torch.nn.MaxPool2d(kernel_size = 2))


model2.add_module('conv3', torch.nn.Conv2d(in_channels=4, out_channels=8, kernel_size
model2.add_module('relu3', torch.nn.ReLU())
model2.add_module('pool3', torch.nn.MaxPool2d(kernel_size = 2))


model2.add_module('Flatten', torch.nn.Flatten())

model2.add_module('fc1', torch.nn.Linear(128, 10))
model2.add_module('relu7', torch.nn.ReLU())
model2.add_module('fc2', torch.nn.Linear(10, 1))

model2.add_module('sigmoid', torch.nn.Sigmoid())
```

In [14]:
```
def simulateData(n, mu_c, mu_n):

    y = np.random.choice([0, 1], size = n, p = [0.5, 0.5])
    m_i = np.random.poisson(lam = mu_c, size = n) * y + np.random.poisson(lam = mu_n,
```

```
    simulated_data = np.zeros([n, 32, 32])
    for i in range(n):
        random_indices = np.random.choice(32 * 32, m_i[i], replace = False)
        row_indices, col_indices = np.unravel_index(random_indices, (32, 32))
        Bi = np.zeros([32, 32])
        Bi[row_indices, col_indices] = 1
        epsilon_i = np.random.normal(loc = 0, scale = np.sqrt(0.04), size = (32, 32))
        simulated_data[i] = Bi + epsilon_i

    return y, simulated_data

class dataSetPytorch(Dataset):
    def __init__(self, x, y):
        self.x = torch.from_numpy(x.reshape([-1, 1, 32, 32])).float()
        self.y = torch.from_numpy(y)
    def __len__(self):
        return len(self.x)
    def __getitem__(self, idx):
        return self.x[idx], self.y[idx]

def makeTestLoader(numExperiments = 10):
    n_test = 1000
    mu_n = [5, 5, 5, 5, 5, 5, 5, 5, 5]
    mu_c = [10, 10, 10, 20, 20, 20, 30, 30, 30]

    dataLoader_experiment_data = []
    for experiment in range(numExperiments):
        dataLoader_settings = []
        for setting in range(9):

            y, simulated_data = simulateData(n = n_test,
                                             mu_c = mu_c[setting],
                                             mu_n = mu_n[setting])

            datasetSetting = dataSetPytorch(simulated_data, y)
            dataLoader = DataLoader(datasetSetting, batch_size=25, shuffle = True)
            dataLoader_settings.append(dataLoader)

        dataLoader_experiment_data.append(dataLoader_settings)

    return dataLoader_experiment_data
```

In [7]:
```
dataLoader_all_experiments_test = makeTestLoader(numExperiments = 10)
```

## Test the models

In [50]:
```
def modelTest(model, test_dataloader):
    accuracy_test = 0
    model.eval()
    with torch.no_grad():
        for x_batch, y_batch in test_dataloader:
            pred = model(x_batch)[:, 0]
            is_correct = ((pred >= 0.5).float() == y_batch).float()
            accuracy_test += is_correct.sum()
    accuracy_test /= len(test_dataloader.dataset)
    print(f'Test Accuracy: {accuracy_test:4f}')
    return accuracy_test.numpy()
```

Note: In the print statment its supposed to be print("Experiment:", experiment, "Setting:", setting + 1) but forgot to change it when i ran the long experiment ..

In [53]:
```
numExperiments = 10
numSettings = 9
accuracyMatrix = np.zeros([numSettings, numExperiments])
for experiment in range(numExperiments):
    dataLoader_individual_experiment_test = dataLoader_all_experiments_test[experiment

    for setting in range(numSettings):
        print("Setting:", setting + 1, "Experiment:", experiment)
        folderPath = 'setting' + str(setting + 1)

        n = len(dataLoader_individual_experiment_test[setting].dataset)
        print("N:", n)

        targetModelName = "Setting" + str(setting + 1) + "_Experiment" + str(experimer
        print(targetModelName)
        modelPath = os.path.join(".", folderPath)  # Constructing the path using os.pa

        # List all files in the modelPath directory that match the targetModelName pat
        modelString = [file for file in glob.glob(os.path.join(modelPath, f"*{targetMo
        print(matching_files)

        modelWeightParams = torch.load(modelString)
        model2.load_state_dict(modelWeightParams)

        accuracy_test = modelTest(model2, dataLoader_individual_experiment_test[settir
        accuracyMatrix[setting, experiment] = accuracy_test
```

```
Setting: 1 Experiment: 0
N: 1000
Setting1_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.604000
Setting: 2 Experiment: 0
N: 1000
Setting2_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.729000
Setting: 3 Experiment: 0
N: 1000
Setting3_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.754000
Setting: 4 Experiment: 0
N: 1000
Setting4_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.968000
Setting: 5 Experiment: 0
N: 1000
Setting5_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.978000
Setting: 6 Experiment: 0
N: 1000
Setting6_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.957000
Setting: 7 Experiment: 0
N: 1000
Setting7_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.988000
Setting: 8 Experiment: 0
N: 1000
Setting8_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.995000
Setting: 9 Experiment: 0
N: 1000
Setting9_Experiment0
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.992000
Setting: 1 Experiment: 1
N: 1000
Setting1_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.732000
Setting: 2 Experiment: 1
N: 1000
Setting2_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.731000
Setting: 3 Experiment: 1
N: 1000
Setting3_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.798000
```

```
Setting: 4 Experiment: 1
N: 1000
Setting4_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.946000
Setting: 5 Experiment: 1
N: 1000
Setting5_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.967000
Setting: 6 Experiment: 1
N: 1000
Setting6_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.957000
Setting: 7 Experiment: 1
N: 1000
Setting7_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.991000
Setting: 8 Experiment: 1
N: 1000
Setting8_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.988000
Setting: 9 Experiment: 1
N: 1000
Setting9_Experiment1
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.991000
Setting: 1 Experiment: 2
N: 1000
Setting1_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.683000
Setting: 2 Experiment: 2
N: 1000
Setting2_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.762000
Setting: 3 Experiment: 2
N: 1000
Setting3_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.752000
Setting: 4 Experiment: 2
N: 1000
Setting4_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.952000
Setting: 5 Experiment: 2
N: 1000
Setting5_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.965000
Setting: 6 Experiment: 2
N: 1000
Setting6_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.967000
```

```
Setting: 7 Experiment: 2
N: 1000
Setting7_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.989000
Setting: 8 Experiment: 2
N: 1000
Setting8_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.990000
Setting: 9 Experiment: 2
N: 1000
Setting9_Experiment2
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.995000
Setting: 1 Experiment: 3
N: 1000
Setting1_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.732000
Setting: 2 Experiment: 3
N: 1000
Setting2_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.771000
Setting: 3 Experiment: 3
N: 1000
Setting3_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.770000
Setting: 4 Experiment: 3
N: 1000
Setting4_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.942000
Setting: 5 Experiment: 3
N: 1000
Setting5_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.957000
Setting: 6 Experiment: 3
N: 1000
Setting6_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.958000
Setting: 7 Experiment: 3
N: 1000
Setting7_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.995000
Setting: 8 Experiment: 3
N: 1000
Setting8_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.994000
Setting: 9 Experiment: 3
N: 1000
Setting9_Experiment3
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.990000
```

```
Setting: 1 Experiment: 4
N: 1000
Setting1_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.724000
Setting: 2 Experiment: 4
N: 1000
Setting2_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.752000
Setting: 3 Experiment: 4
N: 1000
Setting3_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.792000
Setting: 4 Experiment: 4
N: 1000
Setting4_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.941000
Setting: 5 Experiment: 4
N: 1000
Setting5_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.961000
Setting: 6 Experiment: 4
N: 1000
Setting6_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.969000
Setting: 7 Experiment: 4
N: 1000
Setting7_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.989000
Setting: 8 Experiment: 4
N: 1000
Setting8_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.989000
Setting: 9 Experiment: 4
N: 1000
Setting9_Experiment4
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.994000
Setting: 1 Experiment: 5
N: 1000
Setting1_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.712000
Setting: 2 Experiment: 5
N: 1000
Setting2_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.772000
Setting: 3 Experiment: 5
N: 1000
Setting3_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.499000
```

```
Setting: 4 Experiment: 5
N: 1000
Setting4_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.954000
Setting: 5 Experiment: 5
N: 1000
Setting5_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.497000
Setting: 6 Experiment: 5
N: 1000
Setting6_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.966000
Setting: 7 Experiment: 5
N: 1000
Setting7_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.983000
Setting: 8 Experiment: 5
N: 1000
Setting8_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.992000
Setting: 9 Experiment: 5
N: 1000
Setting9_Experiment5
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.996000
Setting: 1 Experiment: 6
N: 1000
Setting1_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.467000
Setting: 2 Experiment: 6
N: 1000
Setting2_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.756000
Setting: 3 Experiment: 6
N: 1000
Setting3_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.511000
Setting: 4 Experiment: 6
N: 1000
Setting4_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.948000
Setting: 5 Experiment: 6
N: 1000
Setting5_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.515000
Setting: 6 Experiment: 6
N: 1000
Setting6_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.964000
```

```
Setting: 7 Experiment: 6
N: 1000
Setting7_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.471000
Setting: 8 Experiment: 6
N: 1000
Setting8_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.482000
Setting: 9 Experiment: 6
N: 1000
Setting9_Experiment6
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.517000
Setting: 1 Experiment: 7
N: 1000
Setting1_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.714000
Setting: 2 Experiment: 7
N: 1000
Setting2_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.518000
Setting: 3 Experiment: 7
N: 1000
Setting3_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.483000
Setting: 4 Experiment: 7
N: 1000
Setting4_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.951000
Setting: 5 Experiment: 7
N: 1000
Setting5_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.966000
Setting: 6 Experiment: 7
N: 1000
Setting6_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.983000
Setting: 7 Experiment: 7
N: 1000
Setting7_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.999000
Setting: 8 Experiment: 7
N: 1000
Setting8_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.991000
Setting: 9 Experiment: 7
N: 1000
Setting9_Experiment7
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.997000
```

```
Setting: 1 Experiment: 8
N: 1000
Setting1_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.470000
Setting: 2 Experiment: 8
N: 1000
Setting2_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.744000
Setting: 3 Experiment: 8
N: 1000
Setting3_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.752000
Setting: 4 Experiment: 8
N: 1000
Setting4_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.941000
Setting: 5 Experiment: 8
N: 1000
Setting5_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.958000
Setting: 6 Experiment: 8
N: 1000
Setting6_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.964000
Setting: 7 Experiment: 8
N: 1000
Setting7_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.990000
Setting: 8 Experiment: 8
N: 1000
Setting8_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.992000
Setting: 9 Experiment: 8
N: 1000
Setting9_Experiment8
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.996000
Setting: 1 Experiment: 9
N: 1000
Setting1_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.766000
Setting: 2 Experiment: 9
N: 1000
Setting2_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.768000
Setting: 3 Experiment: 9
N: 1000
Setting3_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.538000
```

```
Setting: 4 Experiment: 9
N: 1000
Setting4_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.962000
Setting: 5 Experiment: 9
N: 1000
Setting5_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.954000
Setting: 6 Experiment: 9
N: 1000
Setting6_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.960000
Setting: 7 Experiment: 9
N: 1000
Setting7_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.502000
Setting: 8 Experiment: 9
N: 1000
Setting8_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.510000
Setting: 9 Experiment: 9
N: 1000
Setting9_Experiment9
.\setting9\modelSetting9_Experiment9_23_02_2024_epoch_81.pth
Test Accuracy: 0.989000
```

In [54]:
```
accuracyMatrix
```

Out[54]:
```
array([[0.60399997, 0.73199999, 0.68300003, 0.73199999, 0.72399998,
        0.71200001, 0.46700001, 0.71399999, 0.47      , 0.76599997],
       [0.72899997, 0.73100001, 0.76200002, 0.77100003, 0.75199997,
        0.77200001, 0.75599998, 0.51800001, 0.74400002, 0.76800001],
       [0.75400001, 0.79799998, 0.75199997, 0.76999998, 0.792     ,
        0.49900001, 0.51099998, 0.48300001, 0.75199997, 0.53799999],
       [0.96799999, 0.94599998, 0.95200002, 0.94199997, 0.94099998,
        0.954     , 0.94800001, 0.95099998, 0.94099998, 0.96200001],
       [0.97799999, 0.96700001, 0.96499997, 0.95700002, 0.96100003,
        0.49700001, 0.51499999, 0.96600002, 0.958     , 0.954     ],
       [0.95700002, 0.95700002, 0.96700001, 0.958     , 0.96899998,
        0.96600002, 0.96399999, 0.98299998, 0.96399999, 0.95999998],
       [0.98799998, 0.991     , 0.98900002, 0.995     , 0.98900002,
        0.98299998, 0.47099999, 0.99900001, 0.99000001, 0.50199997],
       [0.995     , 0.98799998, 0.99000001, 0.99400002, 0.98900002,
        0.99199998, 0.48199999, 0.991     , 0.99199998, 0.50999999],
       [0.99199998, 0.991     , 0.995     , 0.99000001, 0.99400002,
        0.99599999, 0.51700002, 0.99699998, 0.99599999, 0.98900002]])
```

In [60]:
```
n = [200, 500, 1000, 200, 500, 1000, 200, 500, 1000]
mu_n = [5, 5, 5, 5, 5, 5, 5, 5, 5]
mu_c = [10, 10, 10, 20, 20, 20, 30, 30, 30]
mean_accuracy = accuracyMatrix.mean(axis = 1)
std_accuracy = accuracyMatrix.std(axis = 1)
```

In [63]:
```
# Creating DataFrame
data = {
```

```
    'n': n,
    'mu_n': mu_n,
    'mu_c': mu_c,
    'mean_accuracy': mean_accuracy,
    'std_accuracy': std_accuracy
}

DataSettignsdf = pd.DataFrame(data)
display(DataSettignsdf)
```

| | n | mu_n | mu_c | mean_accuracy | std_accuracy |
|---|---|---|---|---|---|
| **0** | 200 | 5 | 10 | 0.6604 | 0.104083 |
| **1** | 500 | 5 | 10 | 0.7303 | 0.072259 |
| **2** | 1000 | 5 | 10 | 0.6649 | 0.129779 |
| **3** | 200 | 5 | 20 | 0.9505 | 0.008559 |
| **4** | 500 | 5 | 20 | 0.8718 | 0.183053 |
| **5** | 1000 | 5 | 20 | 0.9645 | 0.007393 |
| **6** | 200 | 5 | 30 | 0.8897 | 0.201759 |
| **7** | 500 | 5 | 30 | 0.8923 | 0.198259 |
| **8** | 1000 | 5 | 30 | 0.9457 | 0.142924 |