Problem 4-1. Probability of the Current Observation

```
###################### YOUR CODE HERE ######################
alpha, c = HMMfwd(pi, a, b, obs)
print('=== Probability of the Current Observation ===\n', np.sum(alpha[:,-1]))
############################################################
```

```
=== Probability of the Current Observation ===
 2.1380223436320317e-05
```

Problem 4-2. Most Likely Sequence of States

```
###################### YOUR CODE HERE ######################
path, delta, phi = Viterbi(pi, a, b, obs)
print('=== Most Likely Sequence ===\n', path)
print('====== Path Reference ======\n', phi)
############################################################
```

```
=== Most Likely Sequence ===
 [3 0 0 0 0 1 0 2]
====== Path Reference ======
 [[0 3 0 0 0 0 1 0]
 [0 3 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 0]
 [0 0 2 2 0 0 1 0]]
```

Problem 4-3. Best Fitting Model Parameters

```
###################### YOUR CODE HERE ######################
pi, a, b = BaumWelch(obs, nStates)
print('===== Transition Probability ====\n', a)
print('====== Emission Probability =====\n', b)
print('=== Initial State Probability ===\n', pi)
############################################################
```

```
===== Transition Probability ====
 [[0.00000000e+000 0.00000000e+000 1.00000000e+000 0.00000000e+000]
 [7.68794637e-019 4.99994129e-001 2.05656449e-015 5.00005871e-001]
 [4.82763744e-001 1.00154433e-061 5.17236256e-001 3.53894285e-031]
 [4.09737090e-077 0.00000000e+000 1.00000000e+000 3.86291196e-100]]
====== Emission Probability =====
 [[0.00000000e+00 2.59970825e-68 6.90463459e-01 3.62853588e-01]
 [1.00000000e+00 0.00000000e+00 0.00000000e+00 1.82445405e-01]
 [0.00000000e+00 8.44660960e-01 3.43704961e-26 4.16776305e-01]
 [2.34839669e-05 1.05060749e-31 0.00000000e+00 5.72138770e-01]]
=== Initial State Probability ===
 [0. 1. 0. 0.]
```