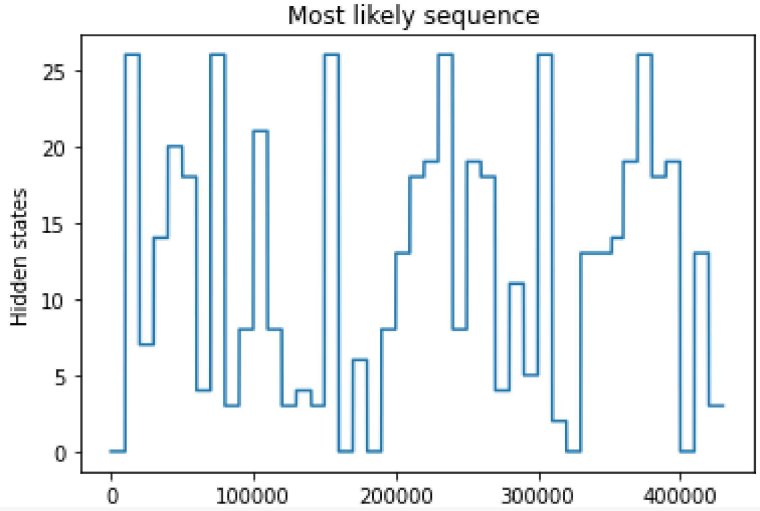
Viterbi Algorithm

```
!unzip /content/hw7files.zip
```

```
import numpy as np
N = 27
transition = np.loadtxt("/content/hw7files/transitionMatrix.txt" , dtype = "float")
observation = np.loadtxt("/content/hw7files/observations.txt" , dtype = "int").reshape(-1,
ISD = np.loadtxt("/content/hw7files/initialStateDistribution.txt" , dtype = "float").resha
eM = np.loadtxt("/content/hw7files/emissionMatrix.txt" , dtype = "float")
T = len(observation)
L_list = np.zeros((27,T))

for i in range(27):
  tmp1 = np.log(ISD[i])
  tmp2 = np.log(eM[i][observation[0]])
  L_list[i][0] = tmp1 + tmp2

final = np.zeros((27,T))
for i in range(27):
  L_list[i][0] = np.log(ISD[i]) + np.log(eM[i][observation[0]])

for t in range(1,T):
  for j in range(27):
    final[j][t] = np.argmax(L_list[:,t-1] + np.log(transition[:,j]))
    L_list[j][t] = np.amax(L_list[:,t-1] + np.log(transition[:,j])) + np.log(eM[j,observat



```

```
Viterbi = []
for i in (range(T-1,-1,-1)):
  if i != T-1:
    Viterbi.append(final[int(Viterbi[-1])][i+1])
  else:
    Viterbi.append(np.argmax(L_list[:,T-1]))

Viterbi = Viterbi[::-1]

import matplotlib.pyplot as plt
plt.plot(Viterbi)
plt.title('Most likely sequence ')
plt.xlabel('time')
plt.ylabel('Hidden states')
```

```
Text(0, 0.5, 'Hidden states')
```




```
foo = 'abcdefghijklmnopqrstuvwxyz '
dick = dict(enumerate(foo))
```

```
verify = ""
count = 0
for t in range(T-1):
  if Viterbi[t] == Viterbi[t+1]:
    count += 1
  else:
    count = 0
  if count > 8000:
    verify += (dick.get(Viterbi[t]))
    count = 0
print(verify)
```

```
a house divided against itself cannot stand
```

Hw 7 Andrea

7.1 - Python

7.2.

$$\alpha_{t+2} -$$

$$= \frac{\alpha_{it}}{P(S_t)} \cdot P(S$$

$$= \frac{\alpha_{it}}{P(S_t)} \times \frac{P(S}{}$$

b) $P(S_t = i / S_t$

$= \frac{P(S_t = i, S_t}{P(S_{t+1} = j}$

(1) is same

$O_1 \dots O_{t-1}$

$\perp\!\!\!\perp$ S_t, S_{t+1}, O_t given S_{t-1}.

di sep.

O_i: $P(S_t$

$= P(S_t, S_{t+1}$

$= P(S_t, S_{t+1}$

$\Rightarrow (C) = a_{i,t}$

7.4

a) $q_{jt} = P(s_t =$

$P(s_t =$

4) We can re

$$P(x_t | y_1 -$$

$$= \int dx_{t-1} P$$

$$= \frac{P(y_{t+1} | x_{t+1})}{Z_t}$$

* The reason
for real hi