Assignment 6

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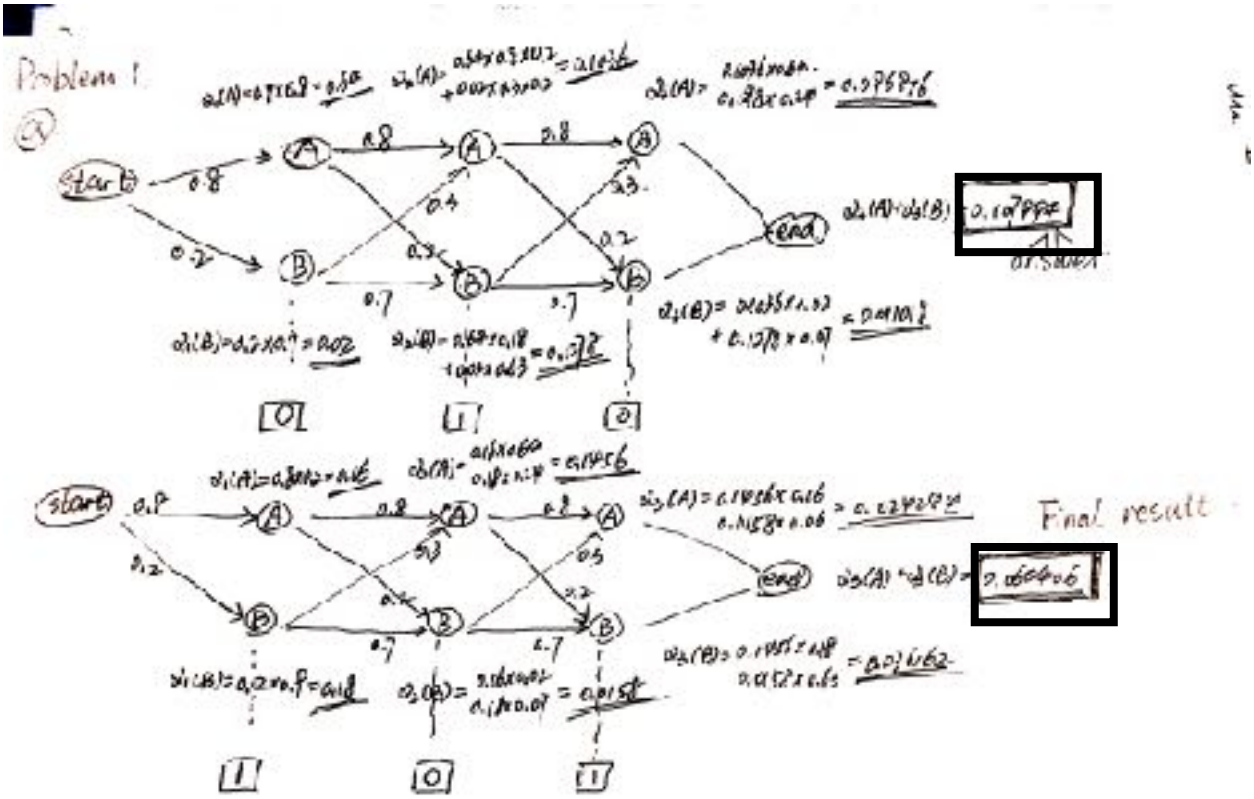
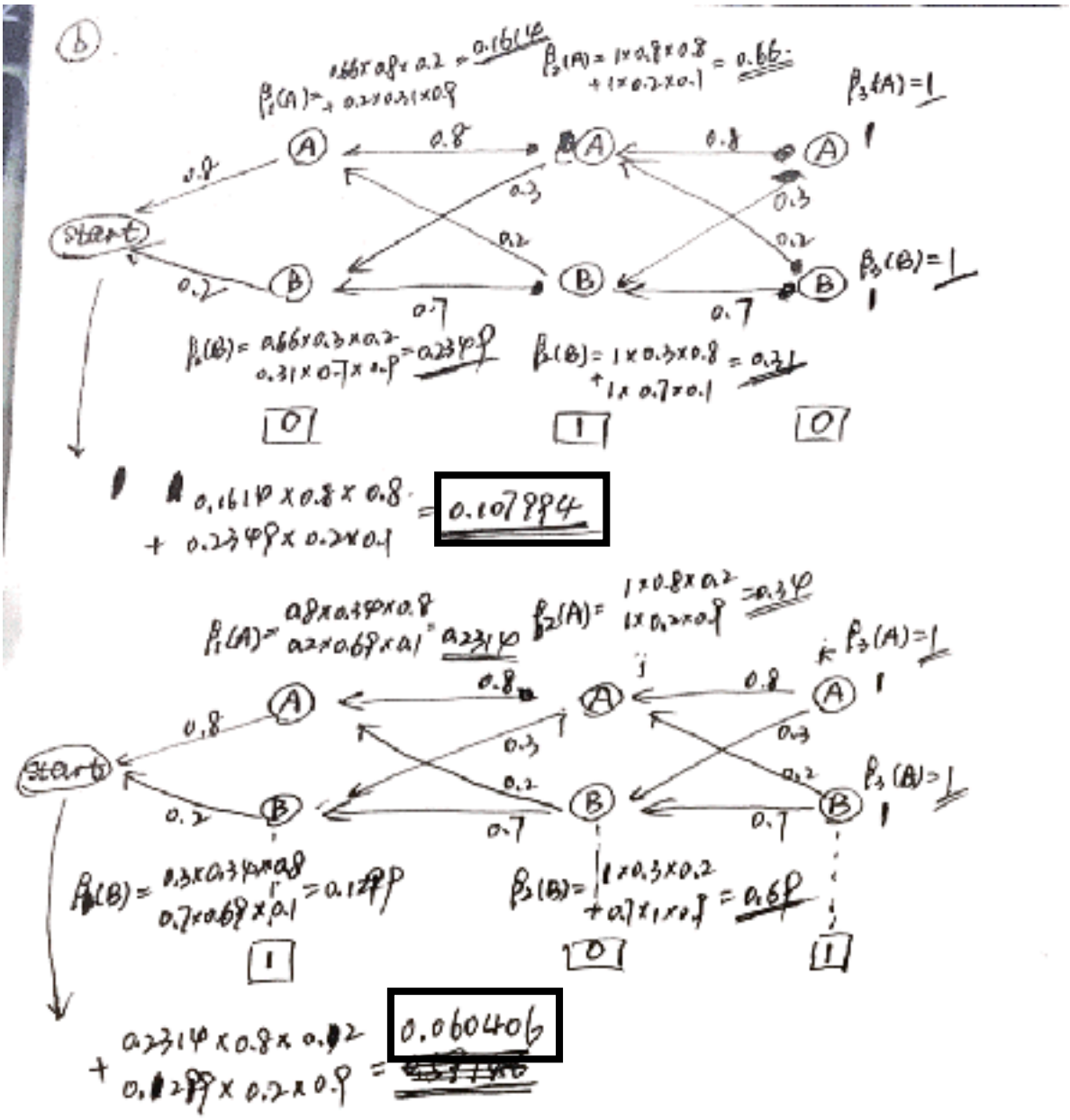
Prob1:

Forward algorithm:





C.Viterbi:

In situation 101, we need find the maximize path, for each state. From what we have calculated above, we can get

For 0, alpha_1(A) > alpha_1(B)

For 1 ,alpha_2(B) > alpha_2(B)

For0, alpha_3(A) > alpha_3(B)

SO the path should be **ABA.**

Prob2:

a:
Calculation is in code
K = 2
Transition prob matrix A:
[0.12044337, 0.87955663]
[0.9910059 , 0.0089941]

Emission Prob matrix B:
[5.9981e-01, 2.0020e-01, 1.99940e-01, 3.180954e-05]
[4.3345e-06, 6.6658e-01, 2.07313e-16, 3.334080e-01]

K = 4
Transition prob matrix A:

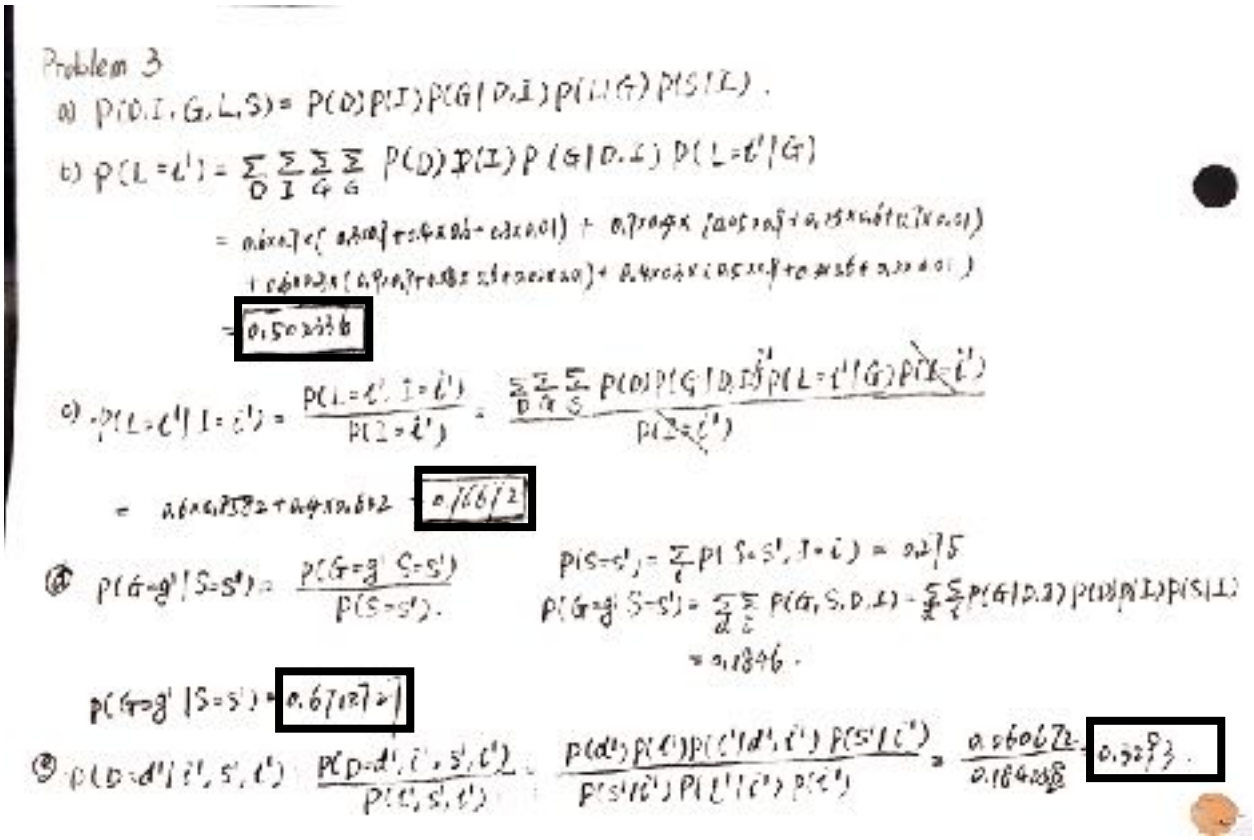
[5.14751e-05, 7.19341e-01, 2.69370e-05, 2.80580e-01]
[4.40058e-02, 3.45646e-04, 4.52532e-01, 5.03116e-01]
[2.09043e-04, 9.99703e-01, 2.79228e-10, 8.72000e-05]
[9.82158e-01, 1.57920e-02, 5.65622e-04, 1.48419e-03]

Emission Prob matrix B:
[8.69938e-01, 1.3001e-01, 2.32347e-08, 4.76056e-05]
[2.49142e-05, 9.89941e-01, 3.1605e-18, 1.00334e-02]
[3.05193e-01, 1.55962e-01, 5.3884e-01, 2.29273e-10],
[3.49642e-01, 2.32387e-03, 3.6455e-06, 6.48029e-01]

b:
K = 2
The most possible state sequence should be **S0—S1-S0-S1.**
For first state we can get the max from emission matrix
and the rest from transition matrix.

K = 4
The most possible state sequence should be **S0-S1-S3-S0.**

Prob 3:


Problem 3
a) P(D,I,G,L,S) = P(D)P(I)P(G|D,I)P(L|G)P(S|I)
b) P(L=l') = Σ_D Σ_I Σ_G Σ_S P(D)P(I)P(G|D,I)P(L=l'|G)
= 0.150215
c) P(L=l'|I=i') = P(L=l', I=i') / P(I=i') = Σ_D Σ_G Σ_S P(D)P(G|D,I)P(L=l'|G)P(S|I=i') / P(I=i')
= 0.16612
d) P(G=g'|S=s') = P(G=g', S=s') / P(S=s')
P(S=s') = Σ_I P(S=s', I=i) = 0.2125
P(G=g', S=s') = Σ_D Σ_I P(G, S, D, I) = Σ_D Σ_I P(G|D,I)P(D)P(I)P(S|I)
= 0.18496
P(G=g'|S=s') = 0.870278
e) P(D=d'|I=i', S=s', L=l') = P(D=d', I=i', S=s', L=l') / P(I=i', S=s', L=l')
= P(d')P(i')P(l'|d',i')P(s'|i') / P(s'|i')P(l'|i')P(i')
= 0.060672 / 0.184288
= 0.32923

Prob4 :

```
first two principal
direction is:
[[-0.24959319 -0.31318631]
 [ 0.25652131 -0.32130825]
 [-0.3468611   0.11181554]
 [-0.005099    0.45672596]
 [-0.34297566  0.21985693]
 [ 0.18943673  0.15387677]
 [-0.31385097  0.31174761]
 [ 0.32173451 -0.34918069]
 [-0.31981745 -0.2703984 ]
 [-0.33853899 -0.23885931]
 [-0.20502118 -0.30870354]
 [ 0.20273245  0.23495727]
 [-0.30984085 -0.07598235]]
```