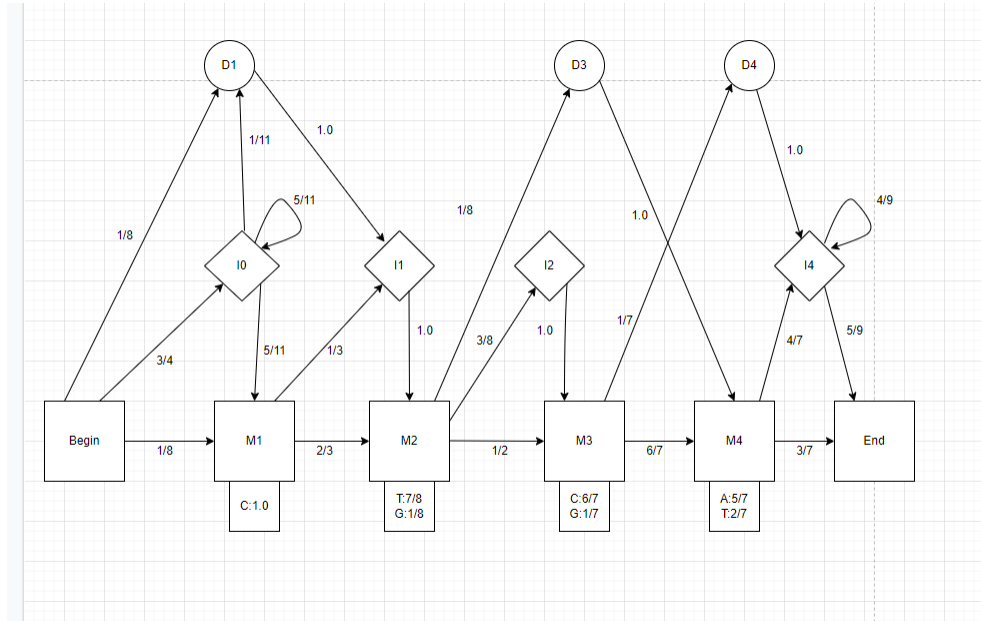


# CENG465 WRITTEN ASSIGNMENT 2

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## 1 Part a



Sequence 1 :  $Begin \rightarrow I_0 \rightarrow I_0 \rightarrow D_1 \rightarrow I_1 \rightarrow M_2 \rightarrow M_3 \rightarrow M_4 \rightarrow I_4 \rightarrow End$

Sequence 2 :  $Begin \rightarrow D_1 \rightarrow I_1 \rightarrow M_2 \rightarrow M_3 \rightarrow M_4 \rightarrow I_4 \rightarrow I_4 \rightarrow End$

Sequence 3 :  $Begin \rightarrow I_0 \rightarrow M_1 \rightarrow I_1 \rightarrow M_2 \rightarrow I_2 \rightarrow M_3 \rightarrow M_4 \rightarrow End$

Sequence 4 :  $Begin \rightarrow I_0 \rightarrow I_0 \rightarrow M_1 \rightarrow M_2 \rightarrow D_3 \rightarrow M_4 \rightarrow I_4 \rightarrow I_4 \rightarrow I_4 \rightarrow End$

Sequence 5 :  $Begin \rightarrow M_1 \rightarrow I_1 \rightarrow M_2 \rightarrow M_3 \rightarrow M_4 \rightarrow End$

Sequence 6 :  $Begin \rightarrow I_0 \rightarrow I_0 \rightarrow M_1 \rightarrow M_2 \rightarrow I_2 \rightarrow M_3 \rightarrow M_4 \rightarrow I_4 \rightarrow I_4 \rightarrow End$

Sequence 7 :  $Begin \rightarrow I_0 \rightarrow I_0 \rightarrow M_1 \rightarrow M_2 \rightarrow I_2 \rightarrow M_3 \rightarrow M_4 \rightarrow End$

Sequence 8 :  $Begin \rightarrow I_0 \rightarrow I_0 \rightarrow M_1 \rightarrow M_2 \rightarrow M_3 \rightarrow D_4 \rightarrow I_4 \rightarrow End$

## 2 Part b

	A	B	C	D	E	F	G	H
1		" "	C	T	C	T	G	A
2	Begin	1.0	0.0	0.0	0.0	0.0	0.0	0.0
3	I0	0.0	1.87E-1	2.12E-2	2.40E-3	2.72E-4	3.09E-5	3.51E-6
4	M1	0.0	1.25E-1	0.0	9.63E-3	0.0	0.0	0.0
5	D1	1.25E-1	1.7E-2	1.92E-3	2.18E-4	2.47E-5	2.80E-6	3.19E-7
6	I1	0.0	3.12E-3	1.04E-2	4.80E-4	8.02E-4	6.17E-6	7.0E-7
7	M2	0.0	0.0	7.29E-2	0.0	5.61E-3	1.00E-4	0.0
8	I2	0.0	0.0	0.0	6.83E-3	0.0	5.25E-4	9.37E-6
9	D3	0.0	0.0	9.11E-3	0.0	7.01E-4	1.25E-5	0.0
10	M3	0.0	0.0	0.0	3.12E-2	0.0	4.00E-4	0.0
11	D4	0.0	0.0	0.0	4.45E-3	0.0	5.71E-5	0.0
12	M4	0.0	0.0	0.0	0.0	7.64E-3	0.0	2.44E-4
13	I4	0.0	0.0	0.0	0.0	1.11E-3	1.09E-3	1.21E-4
14	End	0.0	0.0	0.0	0.0	0.0	0.0	1.04E-4

The probability associated with the best path :  $1.04E - 4$

The best path :  $Begin \rightarrow I_0 \rightarrow I_0 \rightarrow M_1 \rightarrow M_2 \rightarrow M_3 \rightarrow M_4 \rightarrow End$

Here are the calculations :

**2nd row :**

B2 is initialized as 1.0 .B2=C2=...=H2=0.0 since we are at begin state.

**3rd row :**

B3=0.0

C3=B2\*(1/4)\*(3/4)

$$\begin{aligned}
D3 &= C3 * (1/4) * (5/11) \\
E3 &= D3 * (1/4) * (5/11) \\
F3 &= E3 * (1/4) * (5/11) \\
G3 &= F3 * (1/4) * (5/11) \\
H3 &= G3 * (1/4) * (5/11)
\end{aligned}$$

**4th row :**

$$\begin{aligned}
B4 &= 0.0 \\
D4 &= F4 = G4 = H4 = 0 \text{ due to emission probability being 0.} \\
C4 &= \max\{B3 * (1.0) * (5/11), B2 * (1.0) * (1/8)\} = B2 * (1.0) * (1/8) \\
E4 &= \max\{D3 * (1.0) * (5/11), D2 * (1.0) * (1/8)\} = D3 * (1.0) * (5/11)
\end{aligned}$$

**5th row :**

$$\begin{aligned}
B5 &= B2 * (1/8) \\
C5 &= C3 * (1/11) \\
D5 &= D3 * (1/11) \\
E5 &= E3 * (1/11) \\
F5 &= F3 * (1/11) \\
G5 &= G3 * (1/11) \\
H5 &= H3 * (1/11)
\end{aligned}$$

**6th row :**

$$\begin{aligned}
B6 &= 0.0 \\
C6 &= \max\{B5 * (1.0) * (1/4), B4 * (1/3) * (1/4)\} = B5 * (1.0) * (1/4) \\
D6 &= \max\{C5 * (1.0) * (1/4), C4 * (1/3) * (1/4)\} = C4 * (1/3) * (1/4) \\
E6 &= \max\{D5 * (1.0) * (1/4), D4 * (1/3) * (1/4)\} = D5 * (1.0) * (1/4) \\
F6 &= \max\{E5 * (1.0) * (1/4), E4 * (1/3) * (1/4)\} = E4 * (1/3) * (1/4) \\
G6 &= \max\{F5 * (1.0) * (1/4), F4 * (1/3) * (1/4)\} = F5 * (1.0) * (1/4) \\
H6 &= \max\{G5 * (1.0) * (1/4), G4 * (1/3) * (1/4)\} = G5 * (1.0) * (1/4)
\end{aligned}$$

**7th row :**

$$\begin{aligned}
B7 &= 0.0 \\
C7 &= E7 = H7 = 0 \text{ due to emission probability being 0.} \\
D7 &= \max\{C6 * (1.0) * (7/8), C4 * (2/3) * (7/8)\} = C4 * (2/3) * (7/8) \\
F7 &= \max\{E6 * (1.0) * (7/8), E4 * (2/3) * (7/8)\} = E6 * (2/3) * (7/8) \\
G7 &= \max\{F6 * (1.0) * (1/8), F4 * (2/3) * (1/8)\} = F6 * (1.0) * (1/8)
\end{aligned}$$

**8th row :**

$$\begin{aligned}
B8 &= 0.0 \\
C8 &= B7 * (3/8) * (1/4) = 0.0 \\
D8 &= C7 * (3/8) * (1/4) = 0.0 \\
E8 &= D7 * (3/8) * (1/4) \\
F8 &= E7 * (3/8) * (1/4) = 0.0 \\
G8 &= F7 * (3/8) * (1/4)
\end{aligned}$$

$$H8=G7*(3/8)*(1/4)$$

**9th row :**

$$B9=0.0$$

$$C9=C7*(1/8)*(1/4)=0.0$$

$$D9=D7*(1/8)*(1/4)$$

$$E9=E7*(1/8)*(1/4)=0.0$$

$$F9=F7*(1/8)*(1/4)$$

$$G9=G7*(1/8)*(1/4)$$

$$H8=H7*(1/8)*(1/4)=0.0$$

**10th row :**

$$B10=0.0$$

$$D10=F10=H10=0.0 \text{ due to emission probability being } 0$$

$$C10=\max\{B8*(1.0)*(6/7), B7*(1/2)*(6/7)\}=0.0$$

$$E10=\max\{D8*(1.0)*(6/7), D7*(1/2)*(6/7)\}=D7*(1/2)*(6/7)$$

$$G10=\max\{F8*(1.0)*(1/7), F7*(1/2)*(1/7)\}=F7*(1/2)*(1/7)$$

**11th row :**

$$B11=0.0$$

$$C11=C10*(1/7)=0.0$$

$$D11=D10*(1/7)=0.0$$

$$E11=E10*(1/7)$$

$$F11=F10*(1/7)=0.0$$

$$G11=G10*(1/7)$$

$$H11=H10*(1/7)=0.0$$

**12th row :**

$$B12=0.0$$

$$C12=E12=G12=0.0 \text{ due to emission probability being } 0$$

$$D12=\max\{C9*(1.0)*(2/7), C10*(6/7)*(2/7)\}=0.0$$

$$F12=\max\{E9*(1.0)*(2/7), E10*(6/7)*(2/7)\}=E10*(6/7)*(2/7)$$

$$H12=\max\{G9*(1.0)*(5/7), G10*(6/7)*(5/7)\}=G10*(6/7)*(5/7)$$

**13th row :**

$$B13=0.0$$

$$C13=\max\{B11*(1.0)*(1/4), B13*(4/9)*(1/4), B12*(4/7)*(1/4)\}=0.0$$

$$D13=\max\{C11*(1.0)*(1/4), C13*(4/9)*(1/4), C12*(4/7)*(1/4)\}=0.0$$

$$E13=\max\{D11*(1.0)*(1/4), D13*(4/9)*(1/4), D12*(4/7)*(1/4)\}=0.0$$

$$F13=\max\{E11*(1.0)*(1/4), E13*(4/9)*(1/4), E12*(4/7)*(1/4)\}=E11*(1.0)*(1/4)$$

$$G13=\max\{F11*(1.0)*(1/4), F13*(4/9)*(1/4), F12*(4/7)*(1/4)\}=F12*(4/7)*(1/4)$$

$$H13=\max\{G11*(1.0)*(1/4), G13*(4/9)*(1/4), G12*(4/7)*(1/4)\}=G13*(4/9)*(1/4)$$

**14th row :**

$$H14 = \max\{H13 \cdot (5/9), H12 \cdot (3/7)\} = H12 \cdot (3/7)$$

We only calculate H14 and ignore rest since all other columns' calculations means premature end.