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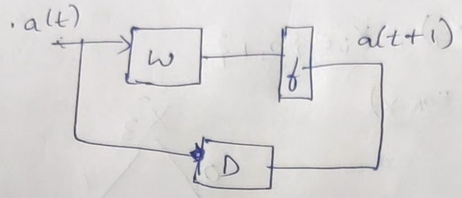
① Ans

ⓐ



$J = (y - a(2))^2$ $\quad w = -1 \quad a(2) = y = -1$

$f(n) = \frac{1}{1+e^{-n}} \quad a(0) = 1 \quad \alpha = 0.1$

$\frac{\partial J}{\partial a_2} = 2(y - a(2))(-1) = -2(y - a_2)$

$\frac{\partial J}{\partial w_1} = \frac{\partial J}{\partial a_2} \cdot \frac{\partial a_2}{\partial w_1}$

$w_1' = w_1 - \alpha \frac{\partial J}{\partial w_1}$

$w_2' = w_2 - \alpha \frac{\partial J}{\partial w_2}$

~~$w_1 = -0.98616$~~

~~$w_2 = -0.981075$~~

~~$f(n) = \frac{1}{1+e^{-n}}$~~ $= f(n) = \frac{1}{1+e^{-n}}$

$= 1/(1 + e^{0.2689})$

$a_2 = \cancel{0.4332}$

$a_2 = 0.43$

$dj = \frac{S(1 - s)ja(1)}{J}$

ⓐ

$a(0) \xrightarrow{w} (f) \xrightarrow[a(1)]{w} (f) \rightarrow (a_2)$

~~$w_1 = -0.98616$~~ $w_1 = -1.018$

~~$w_2 = -0.981075$~~ $\frac{dj}{dw} = 0.18$

$1 + (-1) = 0 \qquad J = [-1 - 0.377]^2$

$f(0) = 1/2 \qquad = 1.896$

$-1/2 + (-1) = -1/2$

$f(-1/2) = \frac{1}{1+\sqrt{e}} = 0.377$

(3) Ans

(2) Ans

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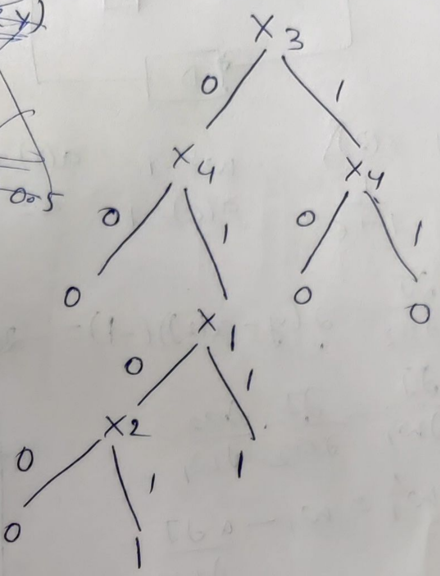
(a) $Y = (X_1 \vee X_2) \wedge (\sim X_3 \wedge X_4)$, $X_i \in \{0, 1\}$

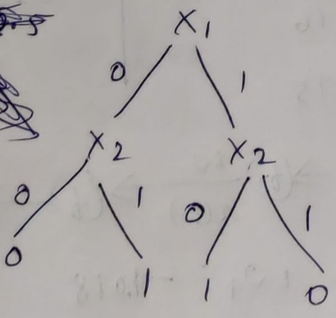
~~$X \otimes Y$ (X XOR Y)~~

~~$X > 0.5$ Yes No $Y > 0.5$ $Y < 0.5$~~



(b) $Y = X_1 \otimes X_2$ $X_i \in \{0, 1\}$

$X_1 \otimes X_2$ XOR funct^n



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③ Ans

$O = \{VS, VL\}$

$$A_1 = \begin{bmatrix} 0.7 & 0.3 \\ 0.3 & 0.7 \end{bmatrix} \quad B_1 = \begin{array}{c} \begin{array}{ccccc} VS & S & M & L & VL \end{array} \\ \begin{bmatrix} 0.1 & 0.2 & 0.2 & 0.2 & 0.3 \\ 0.2 & 0.1 & 0.4 & 0.1 & 0.2 \end{bmatrix} \end{array}$$

$$A_2 = \begin{bmatrix} 0.5 & 0.5 \\ 0.5 & 0.5 \end{bmatrix} \quad B_2 = \begin{bmatrix} 0.1 & 0.1 & 0.1 & 0.1 & 0.6 \\ 0.5 & 0.1 & 0.1 & 0.1 & 0.2 \end{bmatrix}$$

Deducing $P(\lambda_1|O)$ & $P(\lambda_2|O)$ by $P(O|\lambda_1)$, $P(O|\lambda_2)$ using

$\alpha_0(c) = \pi_c b_c(O(VS))$
$= 0.03$
$\alpha_0(H) = 0.14$
$\alpha_1(c) = [\alpha_0(c)a_{cc} + \alpha_0(H)a_{HC}] b_c(\alpha(VL))$
$= 0.0189$
$\alpha_1(H) = [\alpha_0(c)a_{CH} + \alpha_0(H)\alpha_{HH}] b_H(O(VL))$
$= 0.0214$
$P(O|\lambda_1) = \alpha_1(c) + \alpha_1(H)$
$= 0.0403$

$\alpha_0(C) = 0.03$
$\alpha_0(H) = 0.35$
$\alpha_1(c) = [\alpha_0(c)a_{cc} + \alpha_0(H)a_{HC}] b_c O(VL)$
$= 0.114$
$\alpha_1(H) = 0.038$
$P(O|\lambda_2) = 0.152$

Comp $P(O|\lambda_1)$ & $P(O|\lambda_2)$ λ_2 the HMM in (b) would be more likely to cause [VS, VL]

Rough $[0.08 \times 0.3 + 0.14 \times 0.7] \times 0.2 = 0.0214$

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4) Ans Single linkage

P1 P2 P3 P4 P5

(P1, P2) = 0.10

	P1	P2	P3	P4	P5
P1	0				
P2	0.9	0			
P3	0.59	0.36	0		
P4	0.45	0.53	0.56	0	
P5	0.65	0.02	0.15	0.24	0

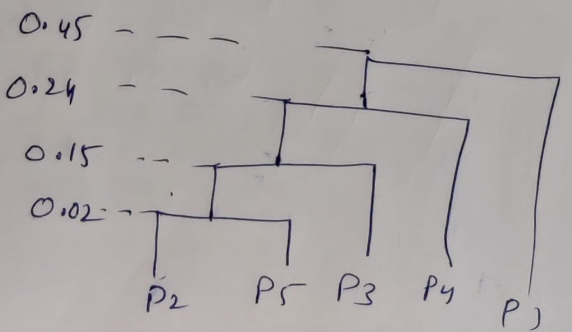
(P2. P5) cluster

	P1	P2 P5	P3	P4
P1	0			
P2 P5	0.65	0		
P3	0.59	0.15	0	
P4	0.45	0.24	0.56	0

(P2, P5), P3

	P1	(P2 P5 P3)	P4
P1	0		
P2 P5 P3	0.59	0	
P4	0.45	0.24	0

	P1	P2 P5 P3 P4
P1	0	
P2 P5 P3 P4	0.45	0



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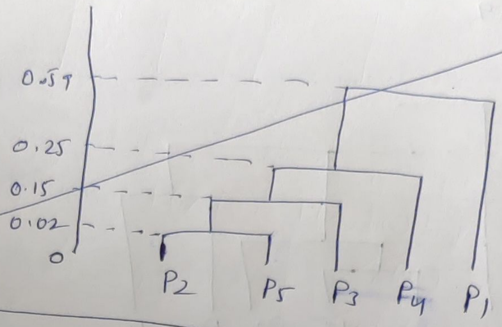
(5)

~~Ans~~

4 Ans

Single dendogram



Complete linkage

	P1	P2	P3	P4	P5
P1	0	0.9	0.59	0.45	0.65
P2	0.9	0	0.36	0.53	0.02
P3	0.59	0.36	0	0.56	0.15
P4	0.45	0.53	0.56	0	0.24
P5	0.65	0.02	0.15	0.24	0

1) P3 < P5 → C1

	C1	P1	P2	P4
C1	0	0.65	0.36	0.45
P1	0.65	0	0.9	0.45
P2	0.36	0.9	0	0.53
P4	0.45	0.45	0.53	0

P3 P1
0.59
P3 P2
0.36

P5 P1
0.65
P5 P2
0.02

2) C1 & P2

	C2	P1	P4
C2	1	0.9	0.53
P1	0.9	1	0.45
P4	0.53	0.45	1

P1 C1
0.65
P4 C1
0.45

P1 P2
0.9
P4 P2
0.53

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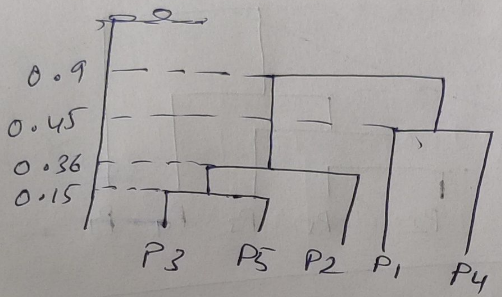
③ C3 P1 P4

C2P1 C2P4

	C2	C3
C2	1	0.9
C3	0.9	1



5) Ans

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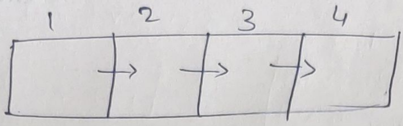


Optimal policy is to move right cell 1 - 4

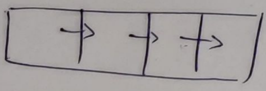
For cell 1,

$$Q_1 = r_{immediate} + \gamma \sum_{i=2}^{4} Q_i$$
$$= 0 + 0.8(0+0+10)$$
$$= 8$$

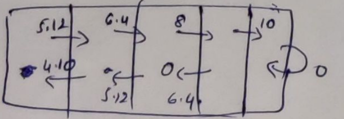
$$Q_2 = r_{immediate} + \gamma \sum_{i=3}^{4} Q_i$$
$$= 0 + 0.8(0+10)$$
$$= 8$$

$$Q_3 = r_{immediate} + \gamma \sum_{i=4} Q_i$$
$$= 8$$

$$Q_4 = r_{immediate}$$
$$Q_4 = 10$$



We should start a walk from leftmost to rightmost only 2nd last state Q is updated then we complete walks again from left to right 2nd pass & update the 3rd state. Since the action to right is of max Q value, optimal Q values stabilize.



$5.12 \rightarrow 6.4 \rightarrow 8 \rightarrow 10 \rightarrow 0$