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18CS10062

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Class Test (A1)

1.(a) Hidden Unit Output $= A(1)(-2)+2)$

$= A(0)$

$= \frac{1}{1+e-0}$

$= \frac{1}{2} = \boxed{0.5}$

Final Output $= (0.5)(4)+0$

$= \boxed{2}$

(b) Error $= \frac{(2-1)^2}{2} = \frac{1}{2} = \boxed{0.5}$

$\{x_2 = 0.52$
$b_2 = 0\}$

(c) $E = \frac{(t-y)^2}{2} = \frac{(x_2 w_2^{+b_2} - y)^2}{2}$

$\frac{\partial E}{\partial w_2} = \frac{\partial}{\partial w_2}(x_2 w_2^{+b_2} - y) = x_2 = 0.5$

Sigmoid Unit output

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(d) $\frac{\partial E}{\partial w_1} = -(t-y)\left(\frac{\partial w_2 x_2 + bias)}{\partial w_2}\right)$

$= -(t-y) w_2 \left(A'(w_1 * inp + bias) \right) w_1$

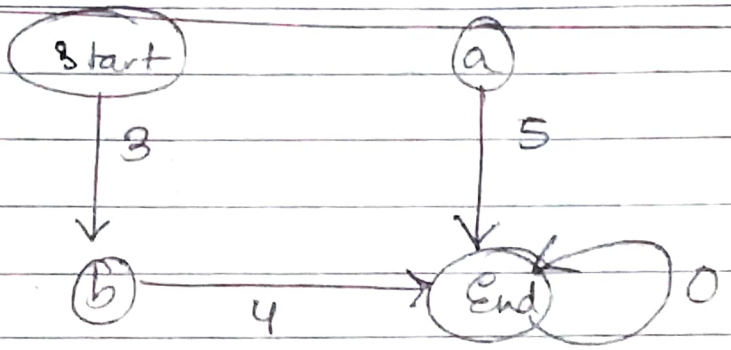
$= -(t-y) w_1 w_2 \left. \frac{e^{-z}}{(1+e^{-z})^2} \right|_{inp=1}$

$= -\left(\frac{1}{4}\right)(-1)(1)(1)$

$\boxed{\frac{\partial E}{\partial w_1} = 1}$

$z = w_1 inp + bias$
$= 2 - 2 = 0.$

2. (a)



(b) $v^*(start) = 6.6$

$v^*(a) = 5$

$v^*(b) = 4$

$v^*(end) = 0$

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(c)

State	value
start	2
a	2
b	2
End	2

For start → b,

$V(\text{Start}) = 2 + (3 + 0.9 \times 2 - 2)$

$= 4.8$

For b → end,

$V(b) = 2 + (4 + 0.9 \times 2 - 2)$

$V(b) = 5.8$

∴ $V(\text{start}) = 4.8$

$V(a) = 2$

$V(b) = 5.8$

$V(\text{end}) = 2$

(d)

State	value
Start	4.8
a	2
b	5.8
End	2

For Start → b,

$V(\text{start}) = 4.8 + (3 + 0.9 \times 5.8 - 4.8)$

$= 8.22$ changed

For b → end,

$V(b) = 5.8 + (4 + 0.9 \times 2 - 5.8)$

$V(b) = 5.8$, $V(\text{start}) = 8.22$, $V(a) = 2$, $V(\text{end}) = 2$

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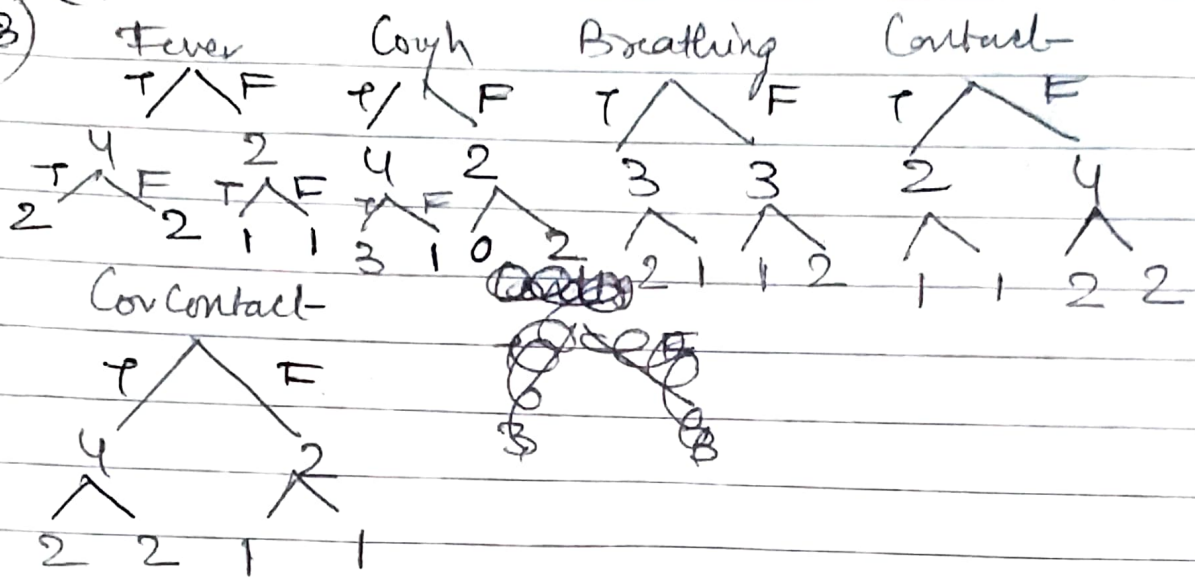
(a)

3)



$$IG(\text{Fever}) = 1 - \left[\frac{4}{6} I\left(\frac{2}{4},\frac{2}{4}\right) + \frac{2}{6} I\left(\frac{1}{2},\frac{1}{2}\right)\right]$$

$$= 1 - \left[\frac{2}{3} I\left(\frac{1}{2},\frac{1}{2}\right) + \frac{1}{3} I\left(\frac{1}{2},\frac{1}{2}\right)\right]$$

$$= 1 - I\left(\frac{1}{2},\frac{1}{2}\right)$$

$$= 1 + \log\left(\frac{1}{2}\right) = 1 - (1 \text{ bit})$$

$$= \underline{0 \text{ bits}}$$

$$IG(\text{Cough}) = 1 - \left[\frac{4}{6} I\left(\frac{3}{4},\frac{1}{4}\right) + \frac{2}{6} I\left(0,\frac{2}{2}\right)\right]$$

$$= 1 - \left[\frac{2}{3} I\left(\frac{3}{4},\frac{1}{4}\right) + \frac{1}{3} I(0,1)\right]$$

$$= 1 - \left[\frac{2}{3} \times 0.81125 + \frac{1}{3} \times 0\right]$$

$$= \underline{0.4591 \text{ bits}}$$

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$$IG(\text{Breathing}) = 1 - \left(\frac{3}{6} I\left(\frac{2}{3}, \frac{1}{3}\right) + \frac{3}{6} I\left(\frac{1}{3}, \frac{2}{3}\right)\right)$$

$$= 1 - \left(\frac{1}{2} I\left(\frac{1}{3}, \frac{1}{3}\right) + \frac{1}{2} I\left(\frac{1}{3}, \frac{2}{3}\right)\right)$$

$$= 1 - I\left(\frac{2}{3}, \frac{1}{3}\right) = 1 - 0.9183 = \underline{0.0817 \text{ bits}}$$

$$IG(\text{Contact}) = 1 - \left(\frac{2}{6} I\left(\frac{1}{2}, \frac{1}{2}\right) + \frac{4}{6} I\left(\frac{2}{4}, \frac{2}{4}\right)\right)$$

$$= 1 - \left(\frac{1}{3} I\left(\frac{1}{2}, \frac{1}{2}\right) + \frac{2}{3} I\left(\frac{1}{2}, \frac{1}{2}\right)\right)$$

$$= \underline{0 \text{ bits}}$$

$$IG(\text{Cor Contact}) = 1 - \left(\frac{4}{6_3} I\left(\frac{2}{4}, \frac{2}{4}\right) + \frac{2}{6_3} I\left(\frac{1}{2}, \frac{1}{2}\right)\right)$$

$$= 1 - \left(\frac{2}{3} I\left(\frac{1}{2}, \frac{1}{2}\right) + \frac{1}{3} I\left(\frac{1}{2}, \frac{1}{2}\right)\right)$$

$$= \underline{0 \text{ bits}}$$

(b) Root = Cough (has highest IG)

No = False = F
Yes = True = T

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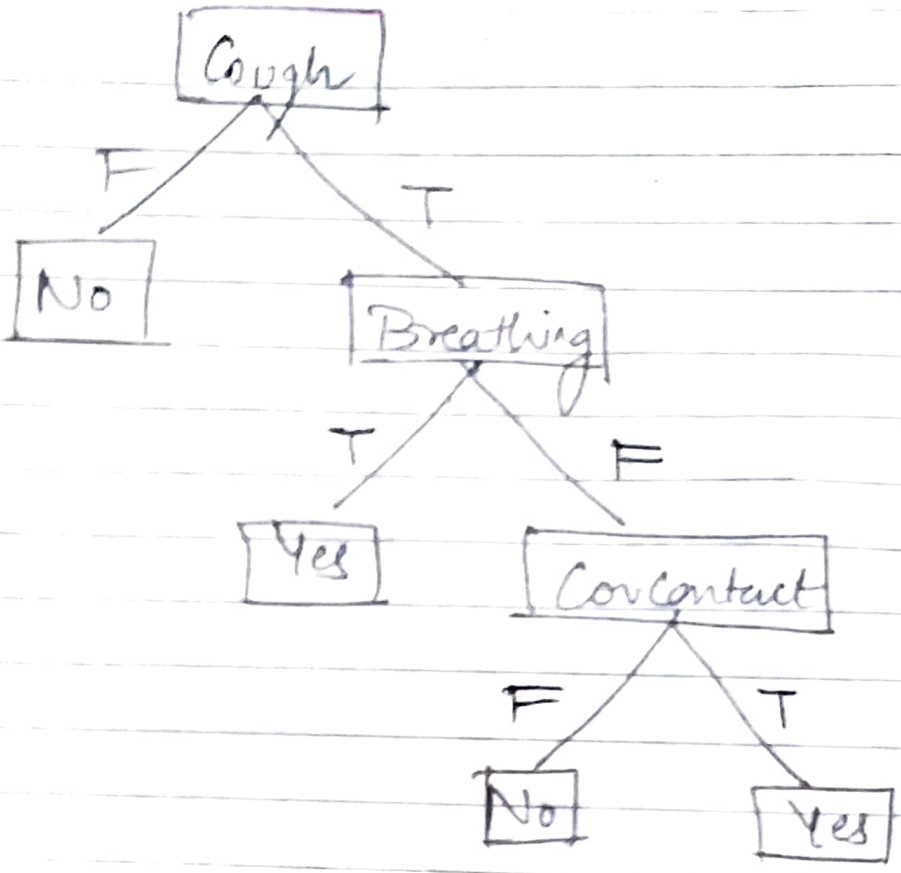
(c)



Cough has highest IG = 0.4591 bits
Then Breathing has 2nd highest IG = 0.0817 bits

All other 3 attributes have similar IGs but using CorContact gives the result.

Check using Tree Paths for each patient

For P1

Cough —T→ Breathing —F→ CorContact —F→ No

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For P2

Cough $\xrightarrow{T}$ Breathing $\xrightarrow{T}$ Yes

For P3

Cough $\xrightarrow{F}$ No

For P4

Cough $\xrightarrow{T}$ Breathing $\xrightarrow{T}$ Yes

For P5

Cough $\xrightarrow{T}$ Breathing $\xrightarrow{F}$ CovContact $\xrightarrow{T}$ Yes

For P6

Cough $\xrightarrow{F}$ No

Hence tree is consistent with training data.