

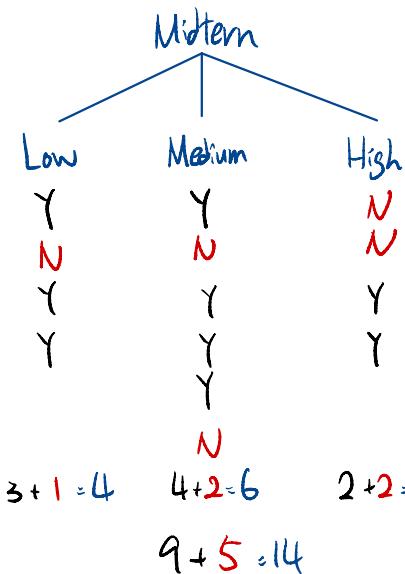
$$En(K) = -\left(\frac{9}{14} \times \log_2\left(\frac{9}{14}\right) + \frac{5}{14} \times \log_2\left(\frac{5}{14}\right)\right) = 0.94029$$

$$En(K_1) = -\left(\frac{2}{6} \times \log_2\left(\frac{2}{6}\right) + \frac{4}{6} \times \log_2\left(\frac{4}{6}\right)\right) = 0.91830$$

$$En(K_2) = -\left(\frac{4}{4} \times \log_2\left(\frac{4}{4}\right) + \frac{0}{4} \times \log_2\left(\frac{0}{4}\right)\right) = 0$$

$$En(K_3) = -\left(\frac{3}{4} \times \log_2\left(\frac{3}{4}\right) + \frac{1}{4} \times \log_2\left(\frac{1}{4}\right)\right) = 0.81128$$

$$\begin{aligned} Gain(K, Temp) &= En(K) - \frac{6}{14} \times En(K_1) - \frac{4}{14} \times En(K_2) - \frac{4}{14} \times En(K_3) \\ &= 0.94029 - \frac{6}{14} \times 0.9183 - \frac{4}{14} \times 0 - \frac{4}{14} \times 0.81128 \\ &= \underline{\underline{0.31494}} \end{aligned}$$



$$En(K) = \text{同上}$$

$$En(K_1) = -\left(\frac{3}{6} \times \log_2\left(\frac{3}{6}\right) + \frac{1}{6} \times \log_2\left(\frac{1}{6}\right)\right) = 0.81128$$

$$En(K_2) = -\left(\frac{4}{6} \times \log_2\left(\frac{4}{6}\right) + \frac{2}{6} \times \log_2\left(\frac{2}{6}\right)\right) = 0.91830$$

$$En(K_3) = -\left(\frac{2}{4} \times \log_2\left(\frac{2}{4}\right) + \frac{2}{4} \times \log_2\left(\frac{2}{4}\right)\right) = 1$$

$$\begin{aligned} Gain(K, \text{Midterm}) &= En(K) - \frac{4}{14} \times En(K_1) - \frac{6}{14} \times En(K_2) - \frac{4}{14} \times En(K_3) \\ &= 0.94029 - \frac{4}{14} \times 0.81128 - \frac{6}{14} \times 0.91830 - \frac{4}{14} \times 1 \\ &= \underline{\underline{0.02922}} \end{aligned}$$

B67611044b ~~後改寫~~

### Homework

Yes

Y

N

Y

Y

Y

Y

Y

No

N

Y

Y

N

Y

N

$$En(K) = 1.32$$

$$En(K_1) = -\left(\frac{6}{7} \times \log_2\left(\frac{6}{7}\right) + \frac{1}{7} \times \log_2\left(\frac{1}{7}\right)\right) = 0.59167$$

$$En(K_2) = -\left(\frac{3}{7} \times \log_2\left(\frac{3}{7}\right) + \frac{4}{7} \times \log_2\left(\frac{4}{7}\right)\right) = 0.98523$$

$$\begin{aligned}Gain(K, \text{Homework}) &= En(K) - \frac{1}{14} \times En(K_1) - \frac{7}{14} \times En(K_2) \\&= 0.94029 - \frac{1}{14} \times 0.59167 - \frac{7}{14} \times 0.98523 \\&= \underline{\underline{0.15184}}\end{aligned}$$

$$6+1=7$$

$$3+4=7$$

$$9+5=14$$

### Quiz

Good

N

N

Y

Y

Y

N

Bad

N

Y

Y

Y

U

Y

Y

$$En(K) = 1.32$$

$$En(K_1) = -\left(\frac{3}{8} \times \log_2\left(\frac{3}{8}\right) + \frac{5}{8} \times \log_2\left(\frac{5}{8}\right)\right) = 1$$

$$En(K_2) = -\left(\frac{6}{8} \times \log_2\left(\frac{6}{8}\right) + \frac{2}{8} \times \log_2\left(\frac{2}{8}\right)\right) = 0.81128$$

$$\begin{aligned}Gain(K, \text{Quiz}) &= En(K) - \frac{6}{14} \times En(K_1) - \frac{8}{14} \times En(K_2) \\&= 0.94029 - \frac{6}{14} \times 1 - \frac{8}{14} \times 0.81128 \\&= \underline{\underline{0.0483}}\end{aligned}$$

$$3+3=6$$

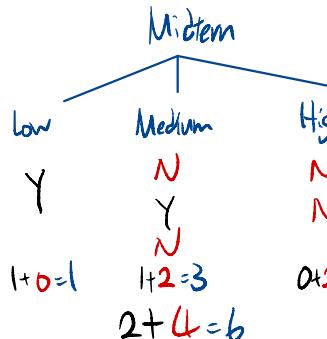
$$6+2=8$$

$$9+5=14$$

$\therefore Gain(K, \text{Temp}) = 0.31494 > \text{other Gains}$

$\therefore$  First layer choose temperature  $\beta$

$< 15^\circ\text{C}$



$$E_n(K) = -\left(\frac{2}{6} \times \log_2\left(\frac{2}{6}\right) + \frac{4}{6} \times \log_2\left(\frac{4}{6}\right)\right) = 0.91830$$

$$E_n(K_1) = -\left(\frac{1}{3} \times \log_2\left(\frac{1}{3}\right) + \frac{2}{3} \times \log_2\left(\frac{2}{3}\right)\right) = 0 \quad \text{Gain}(K_{\text{Midterm}}) = 0.9183 - \frac{1}{3} \times 0$$

$$E_n(K_2) = -\left(\frac{1}{3} \times \log_2\left(\frac{1}{3}\right) + \frac{2}{3} \times \log_2\left(\frac{2}{3}\right)\right) = 0.91830 \quad -\frac{3}{6} \times 0.9183 - \frac{0}{6} \times 0$$

$$E_n(K_3) = -\left(\frac{0}{2} \times \log_2\left(\frac{0}{2}\right) + \frac{2}{2} \times \log_2\left(\frac{2}{2}\right)\right) = 0 \quad = \underline{\underline{0.45915}}$$

Temp

$< 15^\circ\text{C}$

Mid	Hw	Quiz	Go_BBQ
High	No	Bad	No
High	No	Good	No
Medium	No	Bad	No
Low	Yes	Bad	Yes
Medium	Yes	Good	Yes
Medium	No	Good	No

$16-25^\circ\text{C}$

Mid	Hw	Quiz	Go_BBQ
;	;	;	Y
;	;	;	Y
;	;	;	Y
;	;	;	Y

$> 26^\circ\text{C}$

Mid	Hw	Quiz	Go_BBQ
Medium	No	Bad	Yes
Low	Yes	Bad	Yes
Low	Yes	Good	No
Medium	Yes	Bad	Yes

Homework

Yes	No
Y	N
Y	N
Y	N
Y	N

$$2+0=2 \quad 0+4=4$$

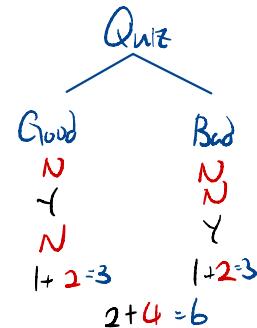
$$2+4=6$$

$$E_n(K) = \underline{\underline{0.45915}}$$

$$E_n(K_1) = -\left(\frac{1}{2} \times \log_2\left(\frac{1}{2}\right) + \frac{1}{2} \times \log_2\left(\frac{1}{2}\right)\right) = 0$$

$$E_n(K_2) = -\left(\frac{1}{4} \times \log_2\left(\frac{1}{4}\right) + \frac{3}{4} \times \log_2\left(\frac{3}{4}\right)\right) = 0$$

$$\text{Gain}(K_{\text{Homework}}) = 0.91830 - \frac{1}{2} \times 0 - \frac{1}{2} \times 0 = \underline{\underline{0.91830}}$$



$$E_n(K) = \underline{\underline{0.45915}}$$

$$E_n(K_1) = -\left(\frac{1}{3} \times \log_2\left(\frac{1}{3}\right) + \frac{2}{3} \times \log_2\left(\frac{2}{3}\right)\right) = 0.91830$$

$$E_n(K_2) = -\left(\frac{1}{3} \times \log_2\left(\frac{1}{3}\right) + \frac{2}{3} \times \log_2\left(\frac{2}{3}\right)\right) = 0.91830$$

$$\text{Gain}(K_{\text{Quiz}}) = 0.91830 - \frac{3}{6} \times 0.91830 - \frac{3}{6} \times 0.91830 = \underline{\underline{0}}$$

Bo761104b (1/2)  $\frac{1}{2}$

$>26^\circ\text{C}$

Midterm

low	Medium	High
Y	Y	
N	Y	
$1+1=2$	$2+0=2$	0
$3+1=4$		

$$En(K) = -\left(\frac{3}{4} \times \log_2\left(\frac{3}{4}\right) + \frac{1}{4} \times \log_2\left(\frac{1}{4}\right)\right) = 0.81128$$

$$En(K_1) = -\left(\frac{1}{2} \times \log_2\left(\frac{1}{2}\right) + \frac{1}{2} \times \log_2\left(\frac{1}{2}\right)\right) = 1 \quad \text{Gain}(K_{\text{Midterm}})$$

$$En(K_2) = -\left(\frac{1}{2} \times \log_2\left(\frac{1}{2}\right) + \frac{1}{2} \times \log_2\left(\frac{1}{2}\right)\right) = 0 \quad = 0.81128 - \frac{3}{4} \times 1 - \frac{1}{2} \times 0 \\ = 0.31128$$

Homework

Yes	No	$En(K) = 0.32$
Y	Y	$En(K_1) = -\left(\frac{2}{3} \times \log_2\left(\frac{2}{3}\right) + \frac{1}{3} \times \log_2\left(\frac{1}{3}\right)\right) = 0.9183$
N		$En(K_2) = -\left(\frac{1}{7} \times \log_2\left(\frac{1}{7}\right) + \frac{6}{7} \times \log_2\left(\frac{6}{7}\right)\right) = 0$
		$\text{Gain}(K_{\text{Homework}}) = 0.81128 - \frac{3}{4} \times 0.9183 - \frac{1}{4} \times 0 \\ = 0.12256$
$2+1=3$	$1+0=1$	
$3+1=4$		

Temp

< 15°C			16-25°C			> 26°C		
Mid	Hw	Quiz	Mid	Hw	Quiz	Mid	Hw	Quiz
High	No	Bad	No			Y		
High	No	Good	No			Y		
Medium	No	Bad	No			Y		
Low	Yes	Bad	Yes			Y		
Medium	Yes	Good	Yes			Y		
Medium	No	Good	No			Y		

Quiz	
Bad	Good
Y	
Y	
Y	
$3+0=3$	$0+1=1$
$3+1=4$	

Mid	Hw	Quiz	Go_BBQ
Medium	No	Bad	Yes
Low	Yes	Bad	Yes
Low	Yes	Good	No
Medium	Yes	Bad	Yes

$$En(K) = 0.32$$

$$En(K_1) = -\left(\frac{3}{3} \times \log_2\left(\frac{3}{3}\right) + \frac{0}{3} \times \log_2\left(\frac{0}{3}\right)\right) = 0$$

$$En(K_2) = -\left(\frac{0}{7} \times \log_2\left(\frac{0}{7}\right) + \frac{6}{7} \times \log_2\left(\frac{6}{7}\right)\right) = 0$$

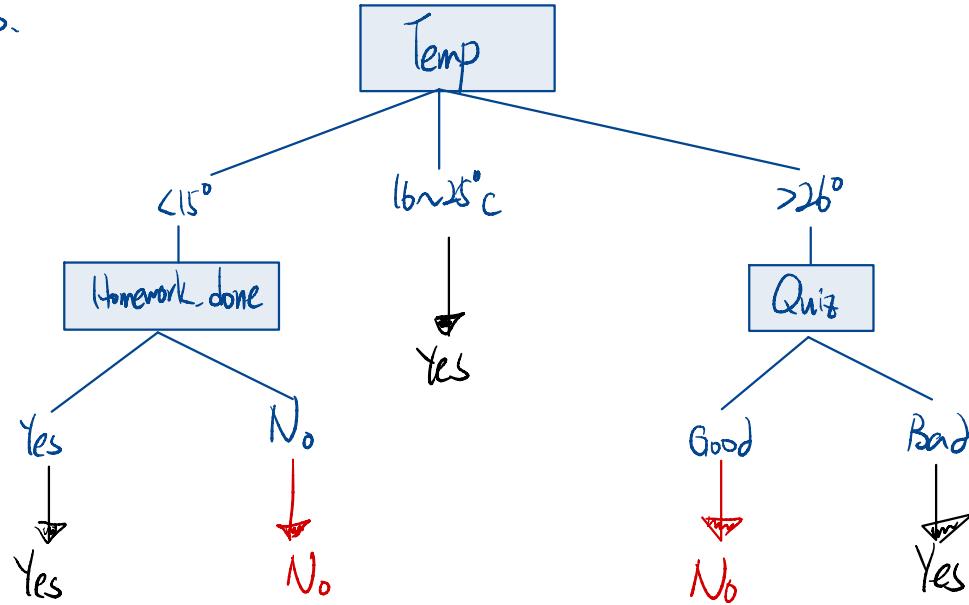
$$\text{Gain}(K_{\text{Quiz}}) = 0.81128 - \frac{3}{4} \times 0 - \frac{1}{4} \times 0 \\ = 0.81128$$

$$\therefore G(K_{\text{Quiz}}) = 0.9183 > \text{other gain}$$

$\therefore$  second layer choose Quiz  $> 26^\circ\text{C}$

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2023-24

Ans.



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