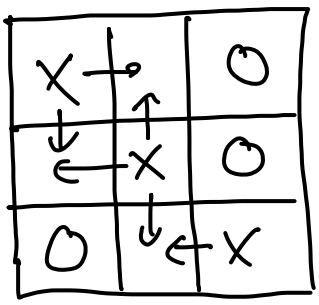
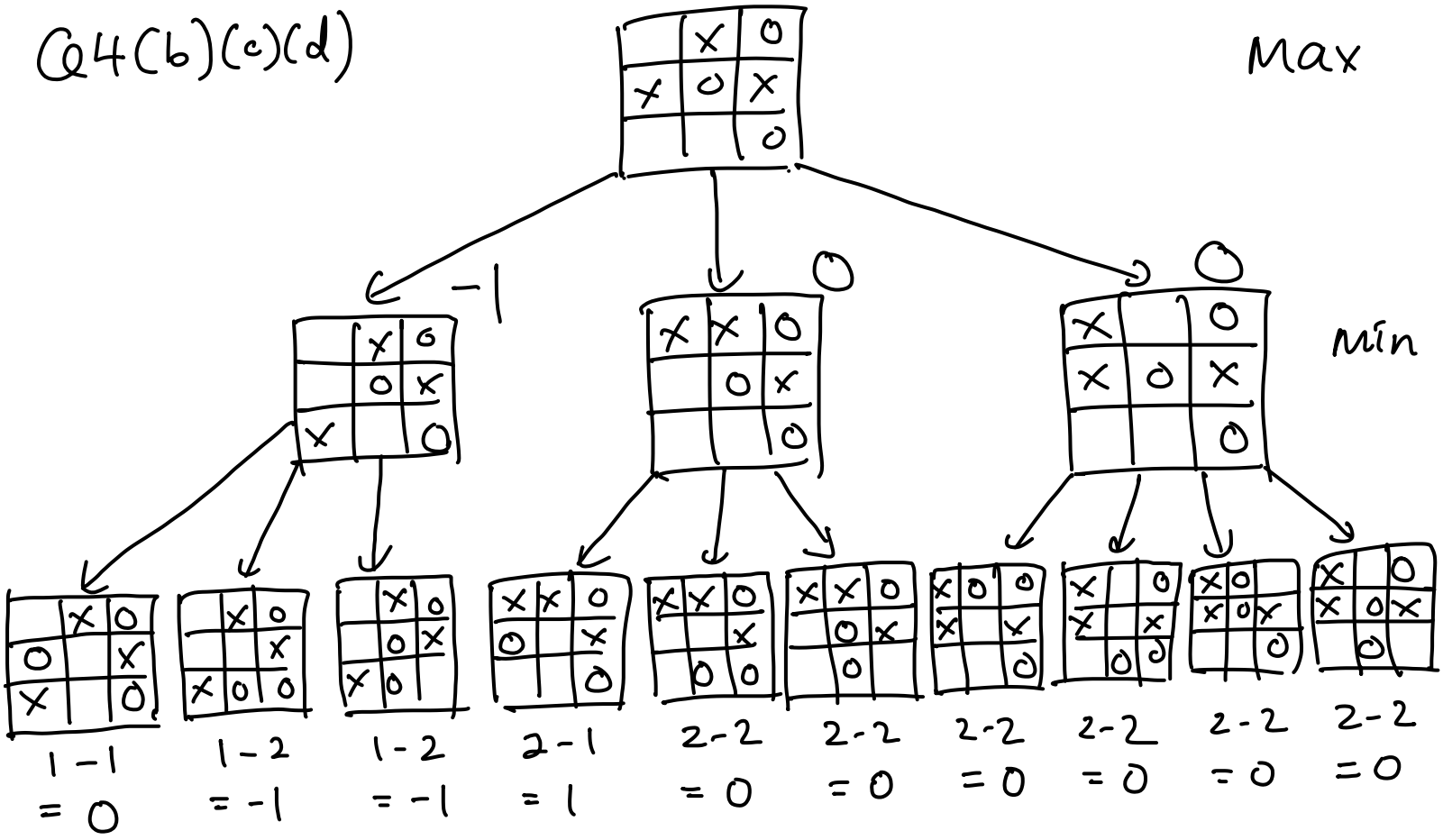
Q4(a)



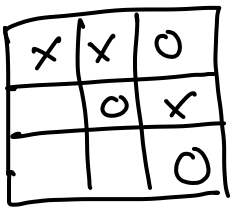
5 possible moves Max.

Branching factor = 5.

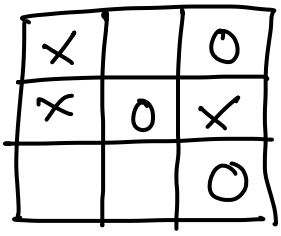
Q4(b)(c)(d)



best move



or



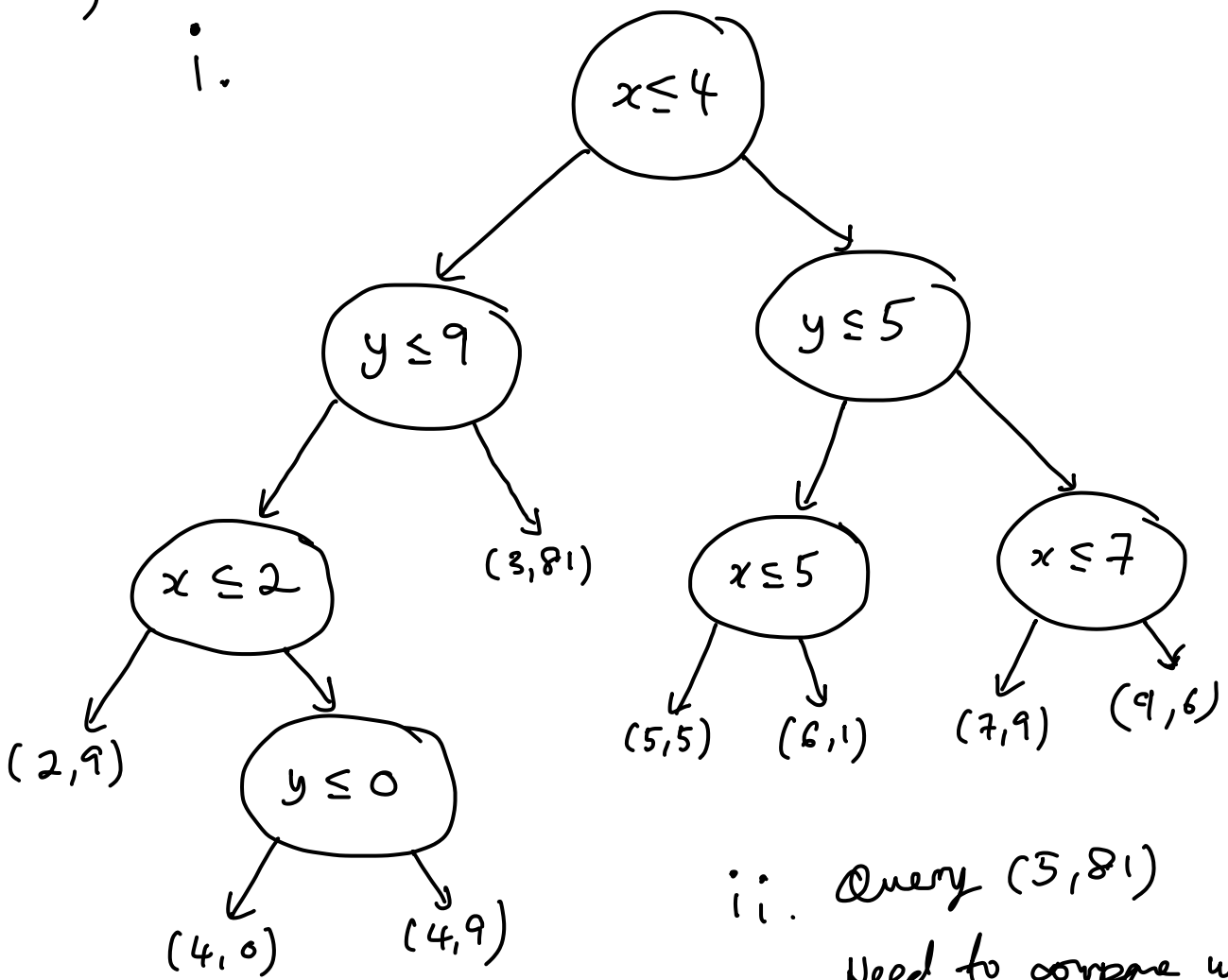
Q5(a) Choose the simplest hypothesis that is consist with the data.

Q5(b) $a = f(w_1 x_1 + w_2 x_2 - w_0)$

$w_1 x_1 + w_2 x_2 - w_0$ is the equation for a line.

Q5(c)

i.



ii. Query (5,8)

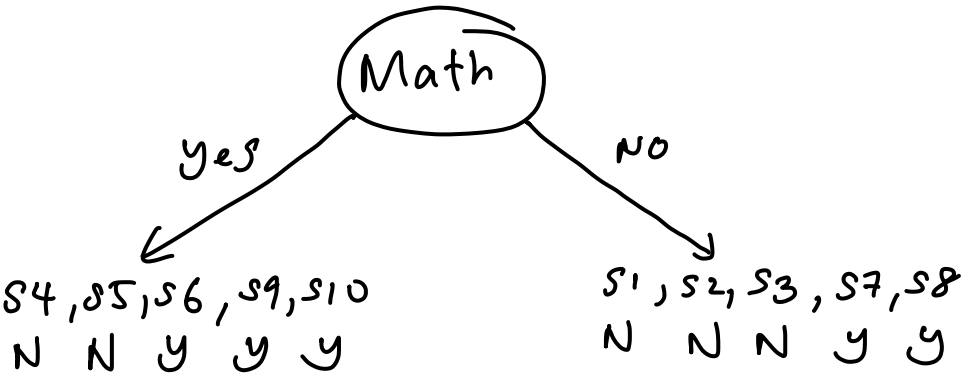
Need to compare with

(7,9)
(9,6)
(6,5)
(6,1)
(3,8)

Q5(d)

i. $I(\text{root}) = 1$ (50/50 split)

ii.



$I(\text{left}) = -\frac{2}{5}\log\frac{2}{5} - \frac{3}{5}\log\frac{3}{5} = 0.4 \times 1.32 + 0.6 \times 0.73$

$I(\text{right}) = -\frac{2}{5}\log\frac{2}{5} - \frac{3}{5}\log\frac{3}{5} = 0.4 \times 1.32 + 0.6 \times 0.73$

$p(\text{left}) = 0.5$

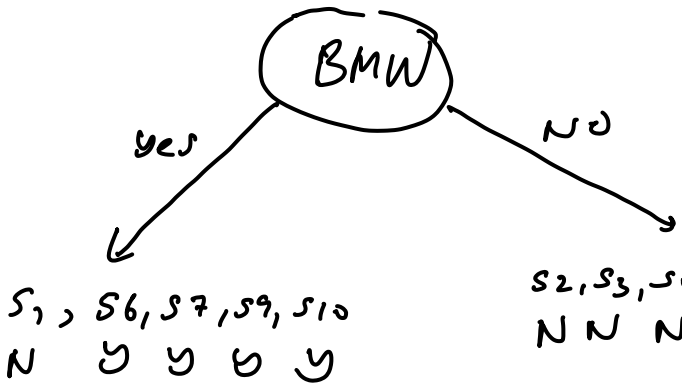
$p(\text{right}) = 0.5$

$\text{Gain}(\text{Math}) = 1 - 0.4 \times 1.32 - 0.6 \times 0.73$

$= 1 - 0.4(0.73 + 0.59) - 0.6 \times 0.73$

$= 1 - 0.73 - 0.4 \times 0.59$

iii. Gain Math is larger



$I(\text{left}) = -\frac{1}{5}\log\frac{1}{5} - \frac{4}{5}\log\frac{4}{5} = 0.2 \times 2.32 + 0.8 \times 0.32$

$I(\text{right}) = -\frac{1}{5}\log\frac{1}{5} - \frac{4}{5}\log\frac{4}{5} = 0.2 \times 2.32 + 0.8 \times 0.32$

$p(\text{left}) = 0.5$

$p(\text{right}) = 0.5$

$\text{Gain}(\text{BMW}) = 1 - 0.2 \times 2.32 - 0.8 \times 0.32$

$= 1 - 0.2(2 + 0.32) - 0.8 \times 0.32$

$= 1 - 0.4 - 0.32 = 1 - 0.72$

Q6(a) Exact inference is too expensive on large networks.

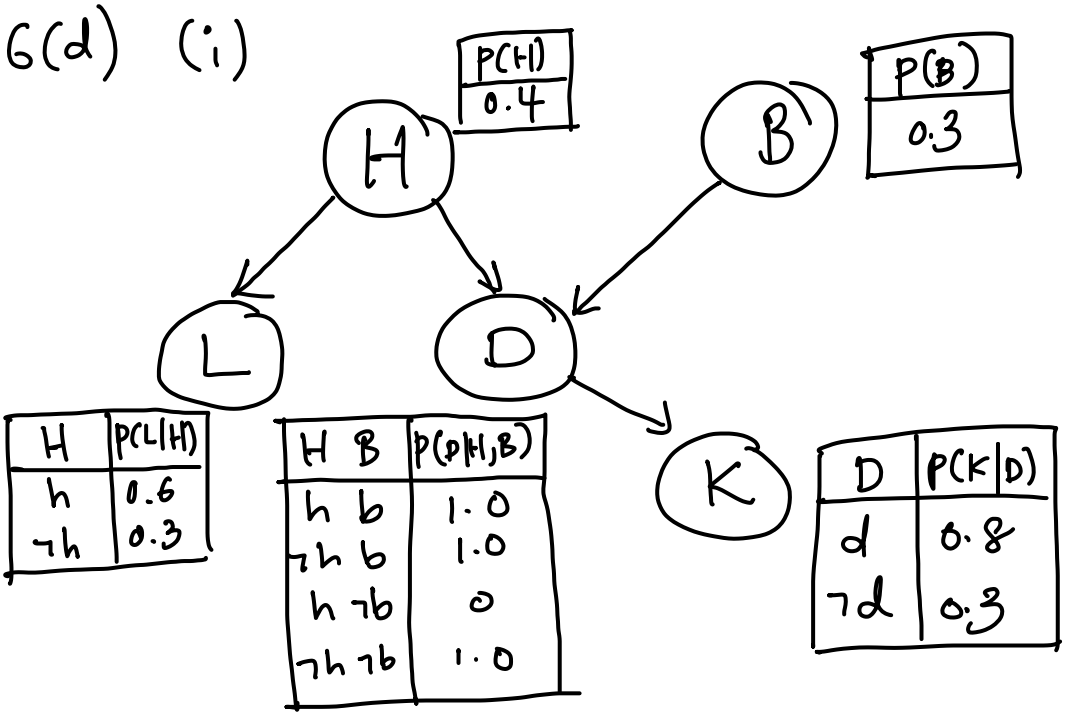
Q6(b) The future state depends only on the current state.

Q6(c)

A = 1	F = 4	K = 16
B = 1	G = 4	L = 1
C = 1	H = 4	M = 1
D = 4	I = 1	
E = 4	J = 1	
10	14	18

Total = 42

Q6(d) (i)



H	P(L|H)
h	0.6
¬h	0.3

H B	P(D|H,B)
h b	1.0
¬h b	1.0
h ¬b	0
¬h ¬b	1.0

D	P(K|D)
d	0.8
¬d	0.3

(ii) $P(H,B,L,D,K) = P(H)\,P(B)\,P(L|H)\,P(D|H,B)\,P(K|D)$

(iii) $P(\neg h|k,l) = \alpha \sum_B \sum_D P(\neg h, k, l, B, D)$

$= \alpha \sum_B \sum_D P(\neg h)\,P(B)\,P(l|\neg h)\,P(D|\neg h,B)\,P(k|D)$

$= \alpha$ .....

Q6(e)

$$T = \begin{array}{c|ccc} & S & P & B \\ \hline S & 0.1 & 0.6 & 0.3 \\ P & 0.6 & 0.1 & 0.3 \\ B & 0.6 & 0.3 & 0.1 \end{array}$$

Day 0 : $f_0 = \begin{bmatrix} 1/3 \\ 1/3 \\ 1/3 \end{bmatrix}$

Day 1 (box) : $O_1 = \begin{bmatrix} 0.7 & & \\ & 0.7 & \\ & & 0.2 \end{bmatrix}$

$$f_1 = \alpha \begin{bmatrix} 0.7 & & \\ & 0.7 & \\ & & 0.2 \end{bmatrix} \begin{bmatrix} 0.1 & 0.6 & 0.6 \\ 0.6 & 0.1 & 0.3 \\ 0.3 & 0.3 & 0.1 \end{bmatrix} \begin{bmatrix} 1/3 \\ 1/3 \\ 1/3 \end{bmatrix}$$

Day 2 (foil) : $O_2 = \begin{bmatrix} 0.3 & & \\ & 0.3 & \\ & & 0.8 \end{bmatrix}$ substitute

$$f_2 = \alpha \begin{bmatrix} 0.3 & & \\ & 0.3 & \\ & & 0.8 \end{bmatrix} \begin{bmatrix} 0.1 & 0.6 & 0.6 \\ 0.6 & 0.1 & 0.3 \\ 0.3 & 0.3 & 0.1 \end{bmatrix} f_1$$