

420-500 HW #3 Solution

1 (1) $\neg P(x) \rightarrow [Q(x,y) \vee R(y)]$

$\Leftrightarrow P(x) \vee Q(x,y) \vee R(y)$

(2) $\neg P(A)$

(3) $\neg Q(w,z) \vee R(w)$

(4) $\neg R(A)$: negated conclusion

(5) $Q(A,y) \vee R(y)$ $\{x/A\}$ (1,2)

(6) $Q(A,A)$ $\{y/A\}$ (4,5)

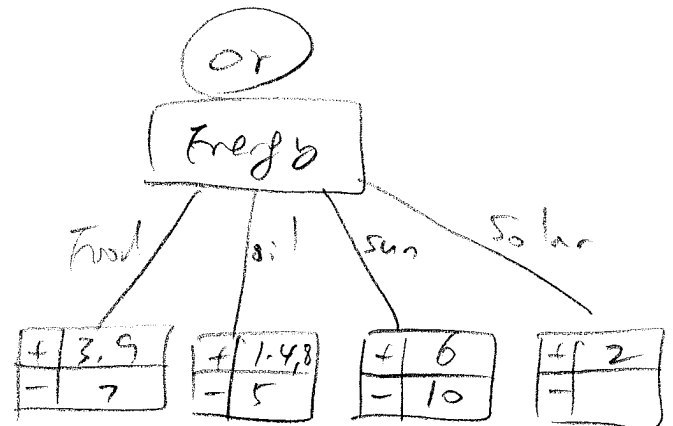
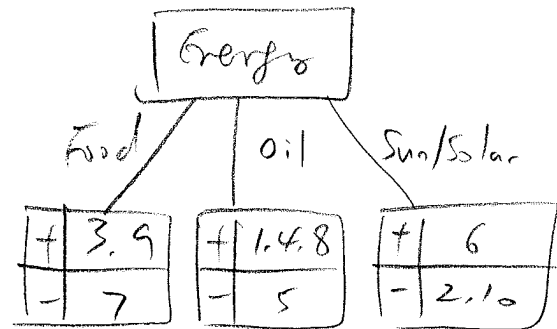
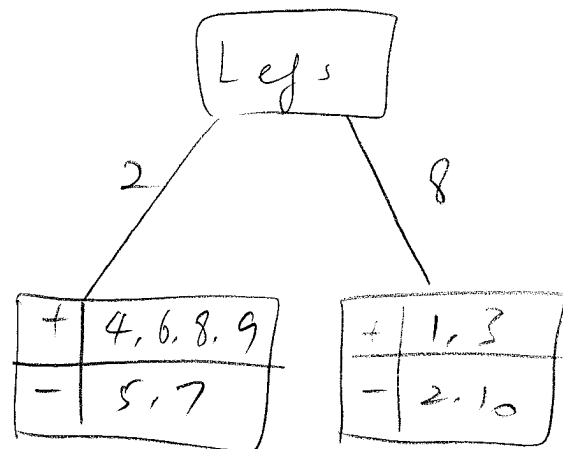
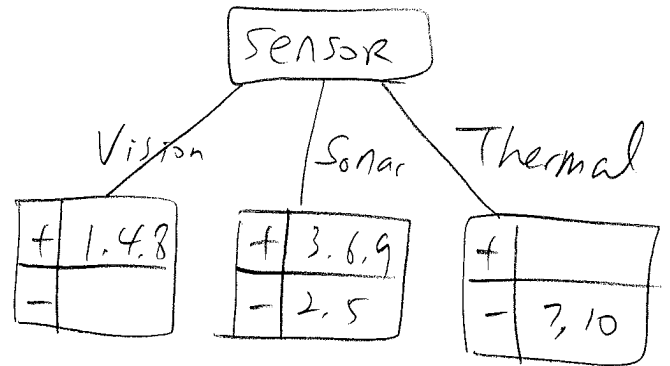
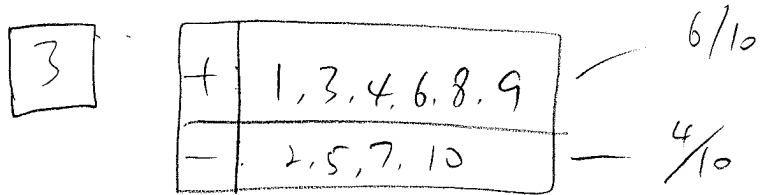
(7) $R(A)$ $\{w/A, z/A\}$ (3,6)

(8) **False** (4,7)

2 $P(\neg J \wedge M \wedge A \wedge \neg E \wedge B)$

$= P(\neg J|A) P(M|A) P(A|\neg E \wedge B) P(\neg E) P(B)$

$= (1-0.9) \times 0.7 \times 0.94 \times 0.998 \times 0.001 = 0.0000656...$



4 Info gain

Sensor:

$$\begin{aligned}
& -\frac{6}{10} \log \frac{6}{10} - \frac{4}{10} \log \frac{4}{10} \\
& - \left[\frac{3}{10} \left(-\frac{3}{3} \log \frac{3}{3} - \frac{0}{3} \log \frac{0}{3} \right) \right. \\
& \quad + \frac{5}{10} \left(-\frac{3}{5} \log \frac{3}{5} - \frac{2}{5} \log \frac{2}{5} \right) \\
& \quad \left. + \frac{2}{10} \left(-\frac{0}{2} \log \frac{0}{2} - \frac{2}{2} \log \frac{2}{2} \right) \right] \\
& = 0.4855
\end{aligned}$$

Levs

$$\begin{aligned}
& -\frac{6}{10} \log \frac{6}{10} - \frac{4}{10} \log \frac{4}{10} \\
& - \left[\frac{6}{10} \left(-\frac{4}{6} \log \frac{4}{6} - \frac{2}{6} \log \frac{2}{6} \right) \right. \\
& \quad \left. + \frac{4}{10} \left(-\frac{2}{2} \log \frac{2}{2} - \frac{2}{2} \log \frac{2}{2} \right) \right] \\
& = 0.0199 \dots
\end{aligned}$$

Energy

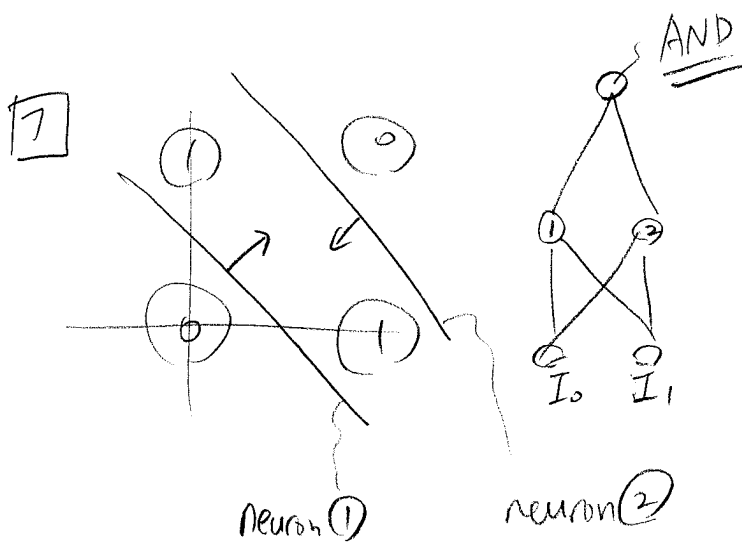
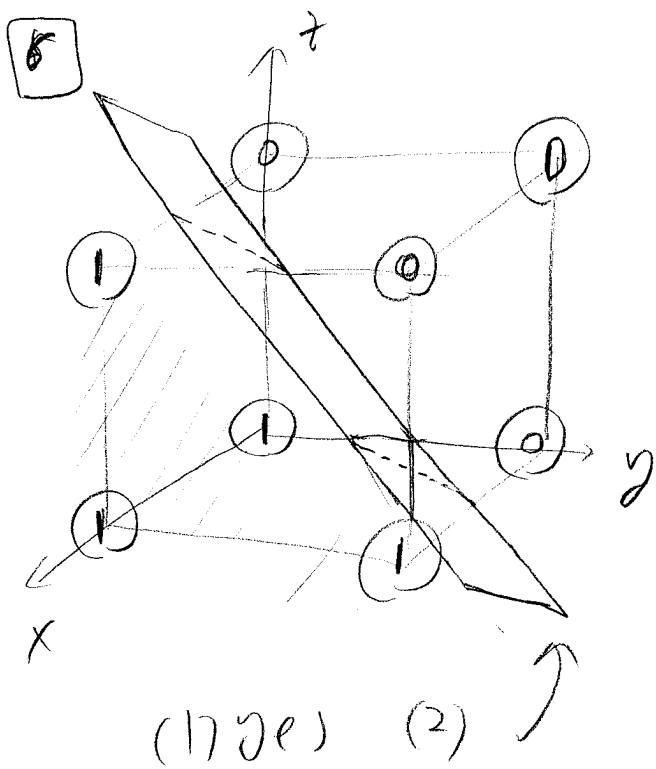
$$\begin{aligned}
& -\frac{6}{10} \log \frac{6}{10} - \frac{4}{10} \log \frac{4}{10} \\
& - \left[\frac{3}{10} \left(-\frac{2}{3} \log \frac{2}{3} - \frac{1}{3} \log \frac{1}{3} \right) \right. \\
& \quad + \frac{4}{10} \left(-\frac{3}{4} \log \frac{3}{4} - \frac{1}{4} \log \frac{1}{4} \right) \\
& \quad \left. + \frac{3}{10} \left(-\frac{1}{3} \log \frac{1}{3} - \frac{2}{3} \log \frac{1}{3} \right) \right] \\
& = 0.0954 \dots
\end{aligned}$$

OR

Energy

$$\begin{aligned}
& -\frac{6}{10} \log \frac{6}{10} - \frac{4}{10} \log \frac{4}{10} \\
& - \left[\frac{3}{10} \left(-\frac{2}{3} \log \frac{2}{3} - \frac{1}{3} \log \frac{1}{3} \right) \right. \\
& \quad + \frac{4}{10} \left(-\frac{3}{4} \log \frac{3}{4} - \frac{1}{4} \log \frac{1}{4} \right) \\
& \quad + \frac{2}{10} \left(-\frac{1}{2} \log \frac{1}{2} - \frac{1}{2} \log \frac{1}{2} \right) \\
& \quad \left. + \frac{1}{10} \left(-\frac{1}{1} \log \frac{1}{1} - \frac{0}{1} \log \frac{0}{1} \right) \right] \\
& = 0.17095 \dots
\end{aligned}$$

5 Pick sensor.



- 8
- ① quantization error
 - ② topographic error

① → encoding

② → feature mapping