

hw4-4710

jh4ctf

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1

1.1

$P(S_2 = Hungry|B_2 = Calm) = P(B_2 = Calm|S_2 = Hungry) * P(S_2 = Hungry) / P(B_2 = Calm) = 1/16 / P(B_2 = Calm)$

$P(B_2 = Calm) = P(B_2 = Calm|S_2 = Hungry) * P(S_2 = Hungry) + P(B_2 = Calm|S_2 = Sleepy) * P(S_2 = Sleepy) = 1/4 * 1/4 + 3/4 * 3/4 = 5/8$
So we can get $P(S_2 = Hungry|B_2 = Calm) = 1/10$

1.2

$U = 1/4 * (-2) + 3/4 * 3 = 7/4$

1.3

Similarly from how we get $P(S_2 = Hungry|B_2 = Calm)$, we can get $P(S_2 = Sleepy|B_2 = Calm) = 9/10$, then we can get $U = 1/10 * (-2) + 9/10 * 3 = 2.5$.

2

2.1

We first calculate $P(E=e)$:

$P(E=A) = 11/40$

$P(E=B) = 11/40$

$P(E=C) = 9/40$

$P(E=D) = 9/40$

Then we compute $P(X = x|E = e) : P(X = x|E = e) = P(E = e|X = x)P(X = x)/P(E = e) = 8/11$

$P(X = A|E = B) = 4/11$

$P(X = A|E = C) = 4/9$

$P(X = A|E = D) = 0$

$P(X = B|E = A) = 1/11$

$$\begin{aligned}
P(X = B|E = B) &= 5/11 \\
P(X = B|E = C) &= 0 \\
P(X = B|E = D) &= 2/9 \\
P(X = C|E = A) &= 1/11 \\
P(X = C|E = B) &= 1/9 \\
P(X = C|E = C) &= 2/9 \\
P(X = C|E = D) &= 1/9 \\
P(X = D|E = A) &= 0 \\
P(X = D|E = B) &= 3/11
\end{aligned}$$

2.2

$$\begin{aligned}
P(\text{ABBCD}) &= 1*0.5*0.5*0.5*0.5 = 1/16 \\
P(\text{ABBA}) &= 0.5*0.5*0.5*0 = 0 \\
P(X_3 = B|X_1 = A, X_2 = B) &= 0.5
\end{aligned}$$

3

3.1

- i. False because to get $P(B, I, M) = P(B)P(I)P(M)$, we will need $I \perp\!\!\!\perp B \perp\!\!\!\perp M$
- ii. True because $J \perp\!\!\!\perp I \perp\!\!\!\perp G$
- iii. True because $M \perp\!\!\!\perp J|G, B, I$

3.2

$$P(b, i, \neg m, g, j) = P(b)P(\neg m)P(g|b, i, \neg m)P(j|g) = 0.9*0.9*0.5*0.8*0.9 = 0.29167$$

3.3

$$\begin{aligned}
P(j \neg b, i, m) &= \\
&= \sum P(j, b, i, m, g') / \sum P(j', b, i, m, g') \\
&= \sum P(b)P(m)P(i|b, m)P(g'|b, i, m)P(j|g') / \sum P(b)P(m)P(i|b, m)P(g'|b, i, m)P(j'|g') \\
&= (0.9*0.9+0)/(0.9*0.1+0+0.9*0.9+0.1) \approx 0.81
\end{aligned}$$

3.4

