

Homework 5 Machine Learning

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1. Yes, should change.

~~Do not change. Choose the right door.~~

~~Do change. Do not choose the right door.~~

~~Do change.~~

Denote $H, I, T \in \{1, 2, 3\}$, where H means the door host choose, T means the door which has the car, and I means the initial door I picked. Suppose I initially picked door 1, and ~~host~~ host picked door 2.

$$\text{So } P[T=1] = P[T=2] = P[T=3] = \frac{1}{3}$$

$$\begin{aligned} \text{If I don't switch: } P[T=1 | I=1, H=2] &= \frac{P(H=2 | T=1, I=1) P(T=1 | I=1)}{\sum_{i=1}^3 P(H=2 | T=i, I=1) P(T=i | I=1)} \\ &= \frac{\frac{1}{2} \times 1}{\frac{1}{2} + 0 + 1} = \frac{1}{3} \end{aligned}$$

$$\text{If I switch: } P[T=2 | I=1, H=2] = 1 - \frac{1}{3} = \frac{2}{3}$$

So I switch.

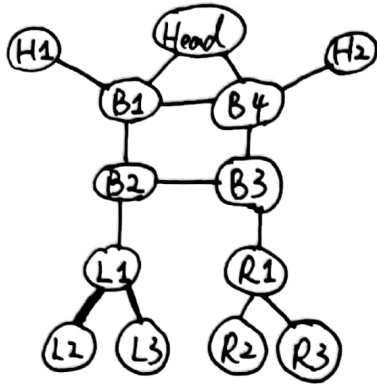
2.

$$P(x_1, \dots, x_5) = P(x_1) P(x_2 | x_1) P(x_3) P(x_4 | x_1, x_2) P(x_5 | x_2, x_4)$$

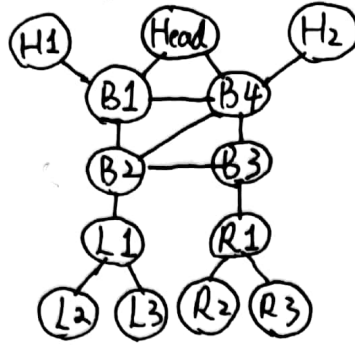
- | | | | | |
|------|------|------|------|-------|
| 1. F | 2. F | 3. T | 4. F | 5. T |
| 6. F | 7. T | 8. T | 9. F | 10. F |

3.

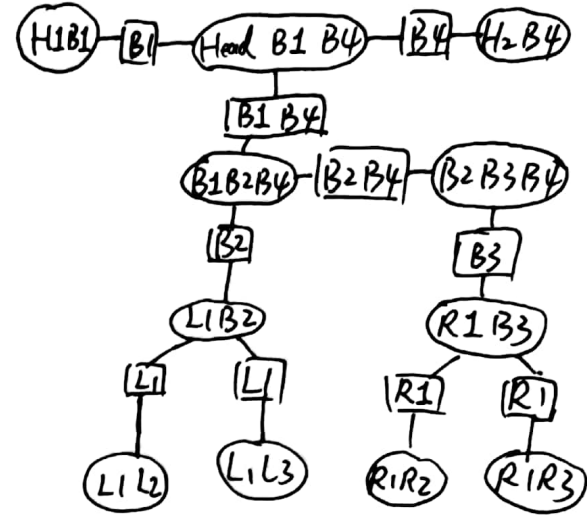
Moralization:



Triangulation:



Junction tree:



4.

Constructed Junction Tree:



Result:

	$X_2 = 0$	$X_2 = 1$	
$X_1 = 0$	0.0405	0.4451	0.4856
$X_1 = 1$	0.3237	0.1908	0.5145
	0.3642	0.6359	

	$X_2 = 0$	$X_2 = 1$	
$X_1 = 0$	0.2601	0.1040	0.3641
$X_1 = 1$	0.0578	0.5780	0.6358
	0.3179	0.6820	

	$X_2 = 0$	$X_2 = 1$	
$X_1 = 0$	0.1192	0.1987	0.3179
$X_1 = 1$	0.6395	0.0426	0.6821
	0.7587	0.2413	

	$X_2 = 0$	$X_2 = 1$	
$X_1 = 0$	0.5690	0.1897	0.7587
$X_1 = 1$	0.0603	0.1810	0.2413
	0.693	0.3707	

5. Using MATLAB, Applying ArgMax Junction Tree Algorithm, we get:

Happy \rightarrow Angry \rightarrow Angry \rightarrow Angry \rightarrow Angry

Code is Attached.

0 means Happy, 1 means Angry in my code.