

Template Models

测验, 10 个问题

✓ 恭喜！您通过了！

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1.

Markov Assumption.

If a dynamic system X satisfies the Markov assumption for all time $t \geq 0$, which of the following statements must be true? You may select 1 or more options.

☐ $(X^{(t+1)} \perp X^{(0:(t-1))} | X^{(t)})$



正确

☐ $(X^{(t+1)} \perp X^{(t)})$



未选择的是正确的

☐ $(X^{(t+1)} \perp X^{(0:(t-1))})$



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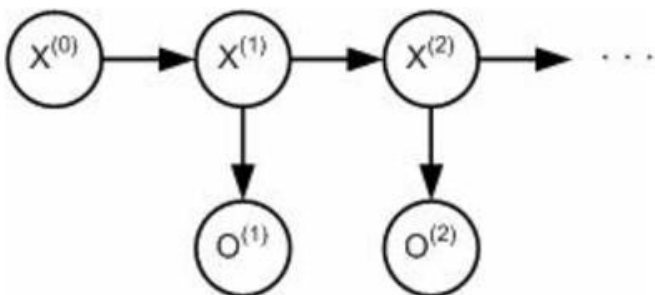


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2.

Independencies in DBNs.

In the following DBN, which of the following independence assumptions are true? You may select 1 or more options.



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☐ $(O^{(t)} \perp O^{(t-1)})$

正确

When $X^{(t)}$ is known, there is no active trail from $X^{(t-1)}$ to any other node in the network that is from a later time-point.

☐ $(X^{(t+1)} \perp X^{(t)} \mid X^{(t-1)})$

未选择的是正确的

☐ $(X^{(t)} \perp X^{(t-1)})$

未选择的是正确的



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3.

Applications of DBNs.

For which of the following applications might one use a DBN (i.e. the Markov assumption is satisfied)? You may select 1 or more options.

☐ Modeling time-series data, where the events at each time-point are influenced by the events at many other time-points.

未选择的是正确的

☐ Modeling the behavior of people, where a person's behavior is influenced by only the behavior of people in the same generation and the people in his/her parents' generation.

正确

Consider each generation to be a time-slice, and this data satisfies the Markov assumption.

☐ Modeling time-series data, where the events at each time-point are influenced by only the events at the one time-point directly before it

正确

This perfectly satisfies the Markov assumption.

☐ Predicting the probability that today will be a snow day (school will be closed because of the snow), when this probability depends only on whether yesterday, the day before yesterday, and 2 Mondays ago were snow days.

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4.

Plate Semantics.

"Let A and B be random variables inside a common plate indexed by i. Which of the following statements must be true? You may select 1 or more options.

☐

For each i, A(i) and B(i) are not independent.



未选择的是正确的

☐

There is an instance of A and an instance of B for every i.



正确

☐

For each i, A(i) and B(i) have the same CPDs.



未选择的是正确的

☐

For each i, A(i) and B(i) have different CPDs.



未选择的是正确的

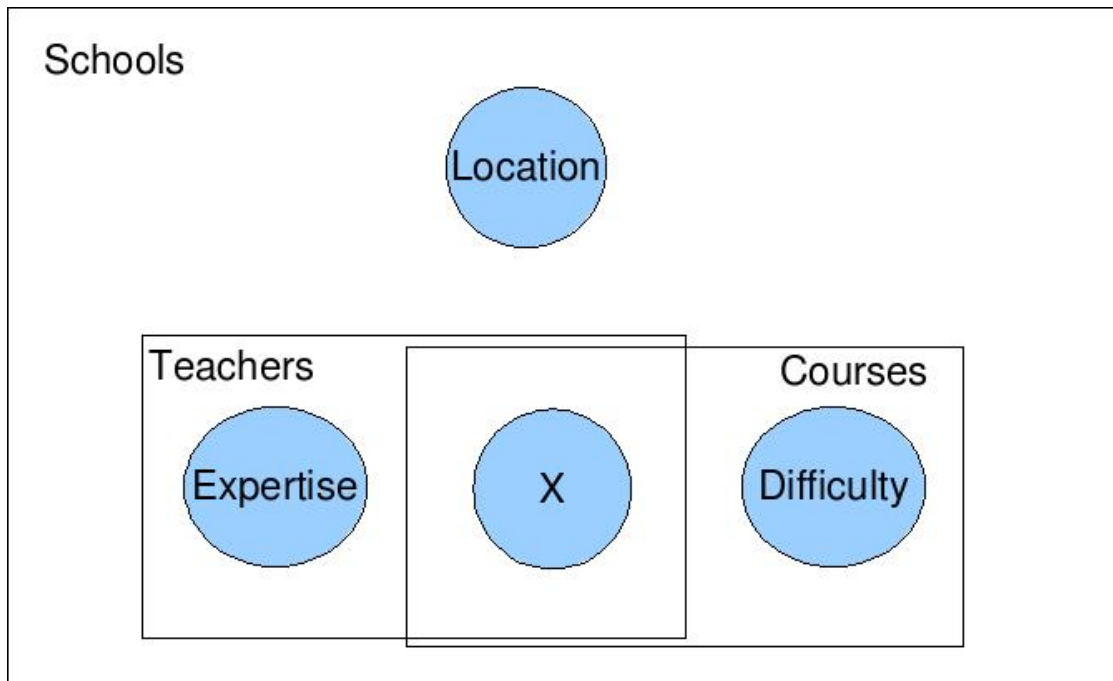


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5.

Plate Interpretation.*Template Models**

Consider the plate model below (with edges removed). Which of the following might a given instance of X possibly represent in the grounded model? (You may select 1 or more options. Keep in mind that this question addresses the variable's semantics, not its CPD.)



☐ None of these options can represent X in the grounded model



未选择的是正确的

☐ Whether a specific teacher T is a tough grader



未选择的是正确的

☐ Whether someone with expertise E taught something of difficulty D at school S



未选择的是正确的

☐ Whether a specific teacher T taught a specific course C at school S



正确

In the grounded model, there will be an instance of X for each combination of Teacher, Course, and School. Thus, we are looking at a random variable that will say something about a specific teacher, class, and school combination. The correct answer is the only one that does this.

☐ Whether a teacher with expertise E taught a course of difficulty D



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6.

Grounded Plates.

Using the same plate model, now assume that there are s schools, t teachers in each school, and c courses taught by each teacher. How many instances of the Expertise variable are there?

- ☐ t
- ☐ s
- ☐ stc
- ☒ st

正确

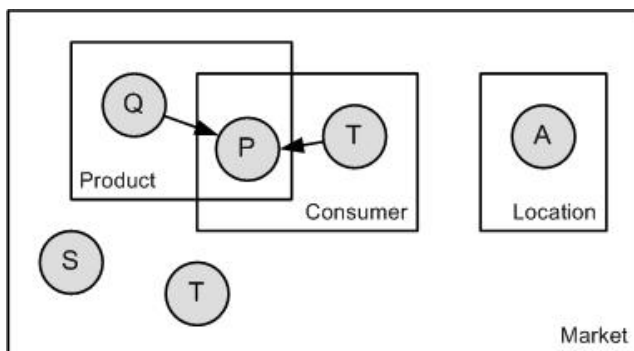
There is a variable for every combination of school and teacher.



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7.

Template Models. Consider the plate model shown below. Assume we are given K Markets, L Products, M Consumers and N Locations. What is the total number of instances of the variable P in the grounded BN?



- ☒ $K \cdot L \cdot M$

正确

There will be one grounded instance of P for each combination of Market, Consumer, and Product. There will be $K \cdot L \cdot M$ of these combinations.

- ☐ $K \cdot (L + M)$
- ☐ $L \cdot M$
- ☐ $K + L + M$

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8.

Template Models. Consider the plate model from the previous question. What might P represent?

- ☒ Whether a specific product PROD was consumed by consumer C in market M

正确

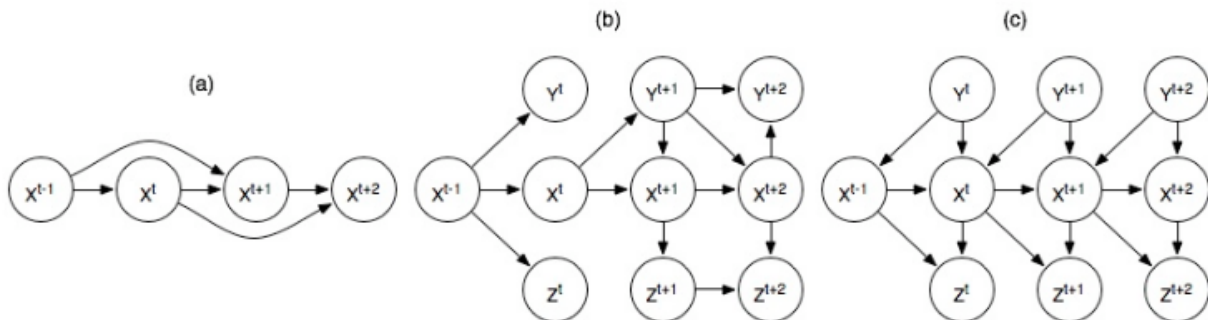
In the grounded model, there will be an instance of P for each combination of Product and Consumer, and there is a combination like this for each Market. Thus, we are looking at a random variable that will say something about a specific product, market, and consumer combination. The correct answer is the only one that does this.

- ☐ Whether a specific product PROD was consumed by consumer C in all markets
- ☐ Whether a specific product of brand q was consumed by a consumer with age t in a market of type m that is in location a
- ☐ Whether a specific product PROD was consumed by consumer C in market M in location L

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9.

Time-Series Graphs. Which of the time-series graphs satisfies the Markov assumption? You may select 1 or more options.



- ☒ (a)

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- ☒ (b)

正确

(b) is a time-series graph in which all variables in each time slice are independent of all variables in time slices at least 2 time slices before, given all variables in the previous time slice ($X^{(t+1)}, Y^{(t+1)}, Z^{(t+1)} \perp X^{(t-1)}, Y^{(t-1)}, Z^{(t-1)} | X^{(t)}, Y^{(t)}, Z^{(t)}$).

- ☒ (c)

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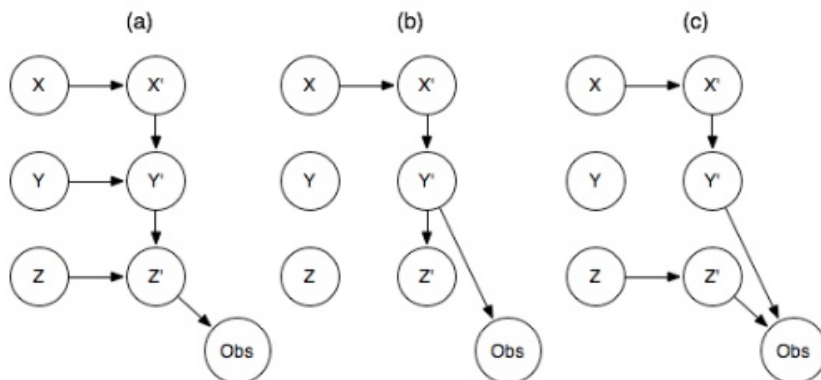


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10.

***Unrolling DBNs.** Below are 2-TBNs that could be unrolled into DBNs. Consider these unrolled DBNs (note that there are no edges within the first time-point). In which of them will $(X^{(t)} \perp Z^{(t)} \mid Y^{(t)})$ hold for all t , assuming $Obs^{(t)}$ is observed for all t and $X^{(t)}$ and $Z^{(t)}$ are never observed? You may select 1 or more options.

Hint: Unroll these 2-TBNs into DBNs that are at least 3 time steps long (i.e., involving variables from $t - 1, t, t + 1$).



(a)



未选择的是正确的



(b)



正确

The independence assumption holds in this network because knowing $Y^{(t)}$ blocks what was the only active trail from $X^{(t)}$ to $Z^{(t)}$.



(c)



未选择的是正确的

