Template Models

10/10 得分 (100%)

返回第 2 周课程

未认证　本次测验未认证。您必须以认证方式重新完成测验，才有资格获得课程证书。

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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.

- [ ] $(X^{(t+1)} \perp X^{(t)})$

正确回答

- [ ] $(X^{(t+1)} \perp X^{(t)} | X^{(t-1)})$

正确回答
Even when $X^{(t-1)}$ is known, $X^{(t)}$ is directly connected to $X^{(t+1)}$, so they are not independent.

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

正确回答

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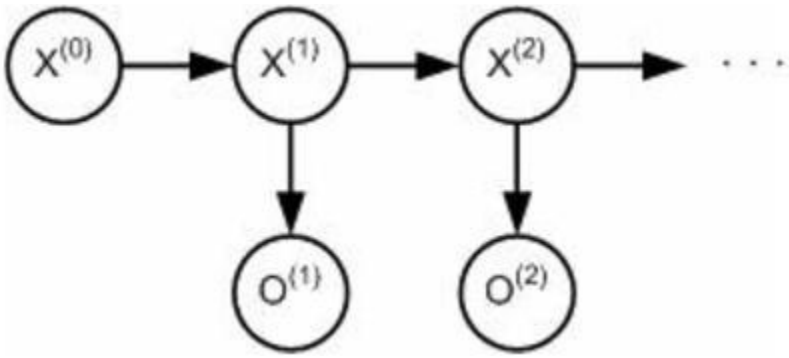
2.

Independencies in DBNs.

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



- [x] $(O^{(t)} \perp O^{(t-1)} \mid X^{(t)})$

正确回答

When $X^{(t)}$ is known, there is no active trail from $O^{(t)}$ to any other node in the network.

- [ ] $(O^{(t)} \perp O^{(t-1)})$

正确回答

$(O^{(t)} \perp O^{(t-1)})$ is wrong because there is an active trail from $O^{(t)}$ to $O^{(t-1)}$ through $X^{(t)}$ and $X^{(t-1)}$.

- [x] $(O^{(t)} \perp X^{(t-1)} \mid X^{(t)})$

正确回答

When $X^{(t)}$ is known, there is no active trail from $O^{(t)}$ to any other node in the network.

- [x] $(O^{(t)} \perp X^{(t+1)} \mid X^{(t)})$

正确回答

When $X^{(t)}$ is known, there is no active trail from $O^{(t)}$ to any other node in the network.

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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.

- [x] 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

正确回答

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.

正确回答

The probability that today will be a snow day depends on whether multiple previous days were snow days, so the Markov assumption is violated.

- [ ] Modeling data taken at different locations along a road, where the data at each location is influenced by the data at many other locations.

正确回答
The data at each location is not independent of the data at other locations, given the data at one location away in any direction, so the Markov assumption is violated.

- [x] 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 was a snow day.

正确回答
Let each day be a time slice, and order the days in chronological order. Viewed in this way, this data satisfies the Markov assumption.

✔ 1 / 1 分

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) have the same CPDs.

正确回答
The CPDs may not be the same for every item. Think about courses as items, with A representing your grade in class and B representing the overall class performance. The CPDs for A and B do not have to be the same for every course.

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

正确回答

- [ ]

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

正确回答

While there is no requirement for A(i) and B(i) to have the same CPDs, it is still possible that A(i) and B(i) could have the exact same CPD in some plate models.

- [x] There is an instance of A and an instance of B for every i.

正确回答

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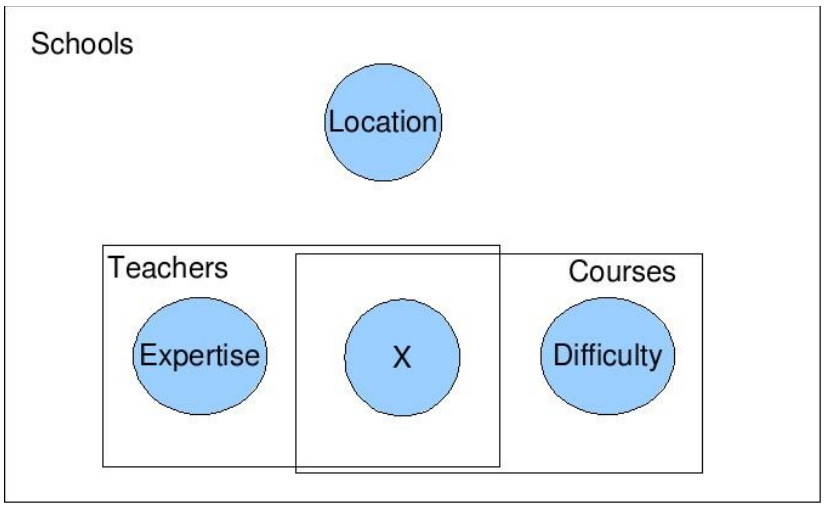
1 / 1 分

5.

***Plate Interpretation.**

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

正确回答
At least one option could represent X.

- [ ] Whether a specific course C is boring

正确回答
In the grounded model, there will be an instance of X for each combination of Teacher and Class, and there is a combination like this for each School. Thus, this model also incorporates teachers and schools.

- [ ] Whether someone with expertise E taught something of difficulty D at school S

正确回答
In the grounded model, there will be an instance of X for each combination of Teacher and Class, and there is a combination like this for each School. Thus, we are looking at a random variable that will say something about a specific teacher, class, and school combination, not a particular expertise, difficulty, and school combination.

- [x] Whether a specific teacher T taught a specific course C at school S

正确回答
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

正确回答

In the grounded model, there will be an instance of X for each combination of Teacher and Class, and there is a combination like this for each School. Thus, we are looking at a random variable that will say something about a specific teacher and class and will also incorporate the school.

✔ 1 / 1 分

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 Difficulty variable are there?

- ○ c
- ◉ sc

正确回答

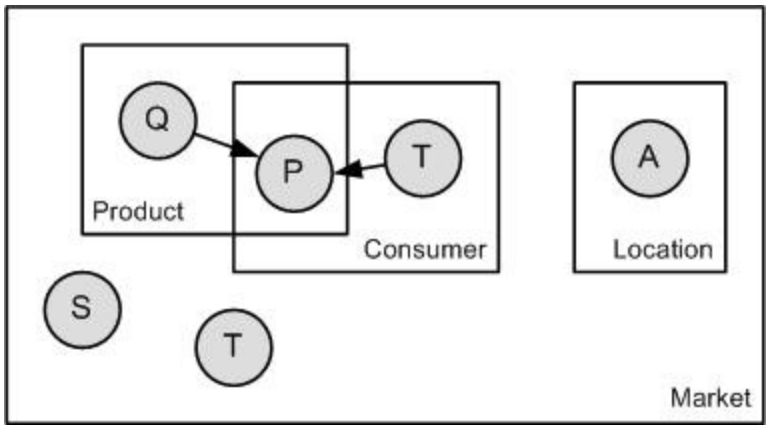
There is a variable for every combination of school and course.

- ○ st
- ○ ct

✔ 1 / 1 分

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?



- [x] $K \cdot L \cdot M$

正确回答

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.

- [ ] $K \cdot (L + M)$
- [ ] $L \cdot M$
- [ ] $K + L + M$

✔ 1 / 1 分

8.

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

- [x] Whether a specific product PROD was consumed by consumer C in market M

正确回答

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 market M that is supervised by supervisor S (assuming that there is exactly 1 unique supervisor per market) and has target audience T (assuming that there is exactly 1 unique target audience per market)
- 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

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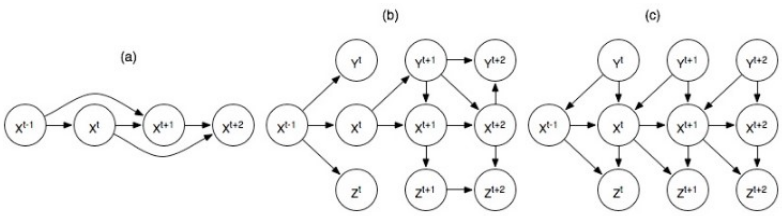
1 / 1 分

9.

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



- [x] (a)

正确回答

In (a), this fails because of the direct edges from nodes to nodes that are two time points away.

☑ (b)

正确回答

(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)

正确回答

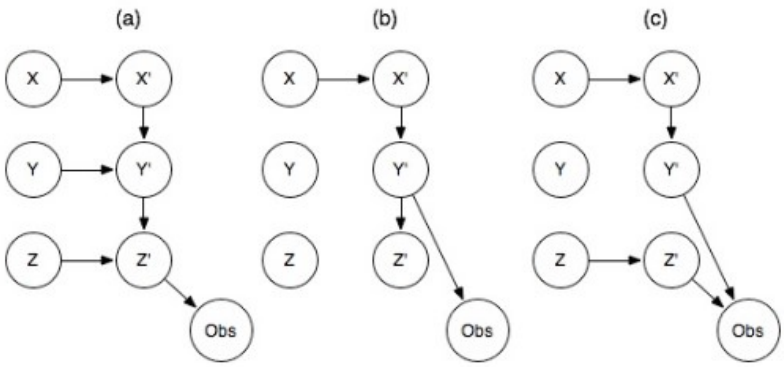
In (c), it fails because of the backwards edges, which cause time-slices to depend on both the previous and the following time-slice.

✔ 1 / 1 分

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)

正确回答

(a) is incorrect because there is still an active path from $X^{(t)}$ to $Z^{(t)}$ through the previous time step variables $(X^{(t)} \leftarrow X^{(t-1)} \rightarrow Y^{(t-1)} \rightarrow Z^{(t-1)} \rightarrow Z)$.

☑ (b)

正确回答

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)

正确回答

(c) is incorrect because of active path
$X^{(t)} \rightarrow X^{(t+1)} \rightarrow Y^{(t+1)} \rightarrow Obs^{(t+1)} \leftarrow Z^{(t+1)} \leftarrow Z^{(t)}$
.