Probabilistic Graphical Models

Daphne Koller, Kevin Murphy
Winter 2011-2012

Home

Quizzes

Theory Problems

Assignments

Assignment Questions

Video Lectures

Discussion Forums

Octave Installation

Lecture Slides

Course Schedule

Course Logistics

Course Information

Course Staff

Feedback — Structured CPDs + Week 1 Review

You achieved a score of 9.00 out of 9.00

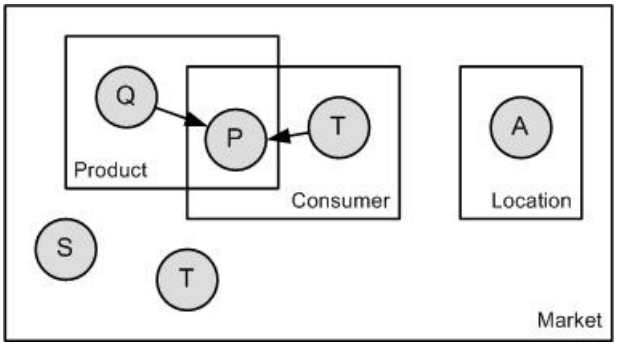
Question 1

I-maps. Suppose $(A \perp B) \in \mathcal{I}(P)$, and G is an I-map of P. Is it necessarily true that $(A \perp B) \in \mathcal{I}($

Your Answer		Score	Explanation
No	✔	1.00	Since G is an I-map of P, all independencies in G are also in P. Howeve this doesn't mean that all independencies in P are also in G. An easy wa remember this is that the complete graph, which has no independencies, an I-map of all distributions.
Total		1.00	

Question 2

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 grounded BN?



Your Answer		Score	Explanation
$K \cdot L \cdot M$	✔	1.00	There will be one grounded instance of P for each combination of Mark Consumer, and Product. There will be $K \cdot L \cdot M$ of these combinations
Total		1.00	

Question 3

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

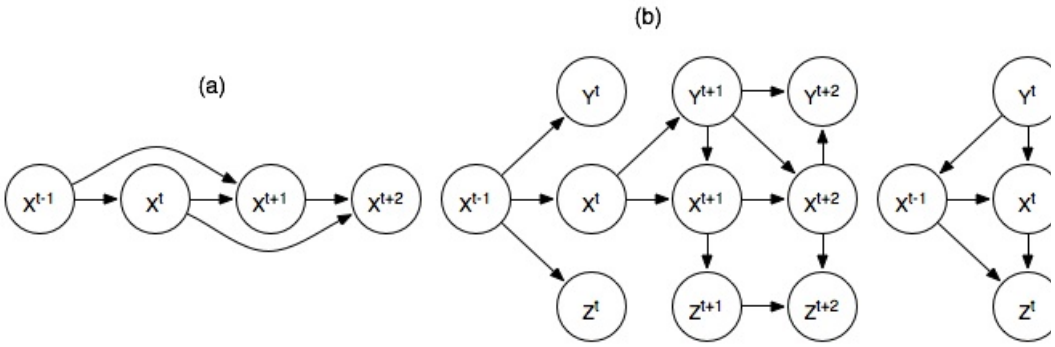
Your Answer	Score	Explanation

Whether a specific product PROD was consumed by consumer C in market M	✔	1.00	In the grounded model, there will be an instance of P for each combination of Product and Consumer, and there is a combinat like this for each Market. Thus, we are looking at a random vari that will say something about a specific product, market, and consumer combination. The correct answer is the only one that does this.
Total		1.00	

Question 4

Time-Series Graphs. Which of the time-series graphs satisfies the Markov assumption? You may s

1 or more options (or none of them, if you think none apply).

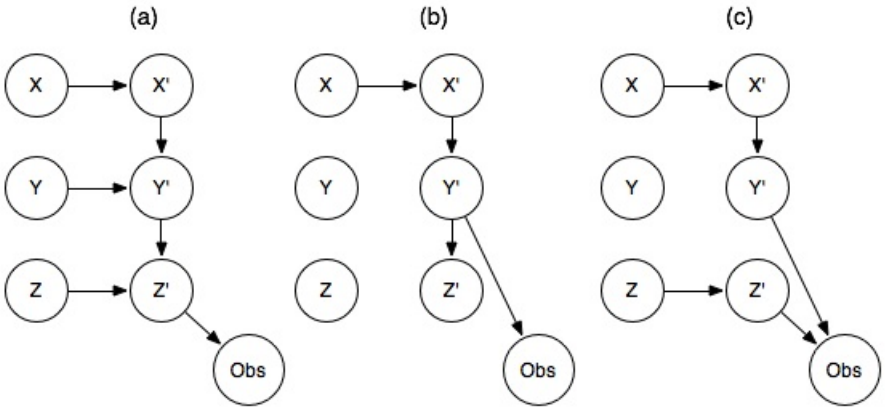


Your Answer		Score	Explanation
(a)	✔	0.33	In (a), this fails because of the direct edges from nodes to nodes that are two time points away.
(b)	✔	0.33	(b) is a time-series graph in which all variables in each time slice are independent of all variables in time slices at least 2 time slices before, gi all variables in the previous time slice ($X^{(t+1)}, Y^{(t+1)}, Z^{(t+1)} \perp X^{(t-1)}, Y^{(t-1)}, Z^{(t-1)} \mid X^{(t)}, Y^{(t)}, Z^{(t)}$).
(c)	✔	0.33	In (c), it fails because of the backwards edges, which cause time-slices t depend on both the previous and the following time-slice.
Total		1.00	

Question 5

***Unrolling DBNs.** Below are 2-TBNs that could be unrolled into DBNs. Consider these unrolled DBN (note that there are no edges within the first time-point). In which of them will $(X^{(t)} \perp Z^{(t)} \mid Y^{(t)})$ ho for all t, assuming $Obs^{(t)}$ is observed for all t and $X^{(t)}$ and $Z^{(t)}$ are never observed? You may sele or more options (or none of them, if you think none apply).

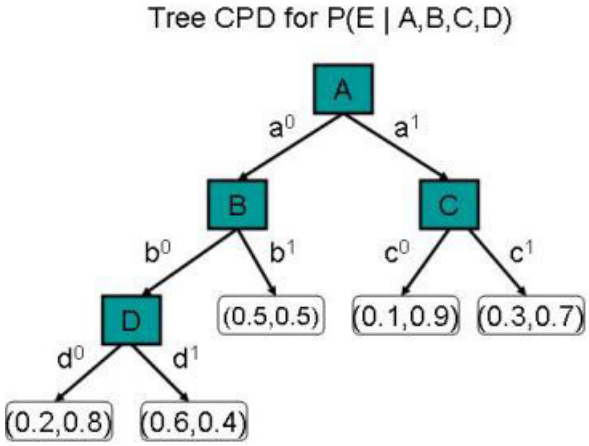
Hint: Unroll these 2-TBNs into DBNs that are at least 3 time steps long (i.e., involving variables from $t-1, t, t+1$).



Your Answer		Score	Explanation
(a)	✔	0.33	(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)	✔	0.33	The independence assumption holds in this network because knowing Y blocks what was the only active trail from $X^{(t)}$ to $Z^{(t)}$.
(c)	✔	0.33	(c) is incorrect because of active path $X^{(t)} \rightarrow X^{(t+1)} \rightarrow Y^{(t+1)} \rightarrow Obs^{(t+1)} \leftarrow Z^{(t+1)} \leftarrow Z^{(t)}$.
Total		1.00	

Question 6

Causal Influence. Consider the CPD below. What is the probability that $E = e_0$ in the following gra given an observation $A = a_1, B = b_0, C = c_0, D = d_1$? Note that, for the pairs of probabilities tha make up the leaves, the probability on the left is the probability of e_0, and the probability on the right the probability of e_1.



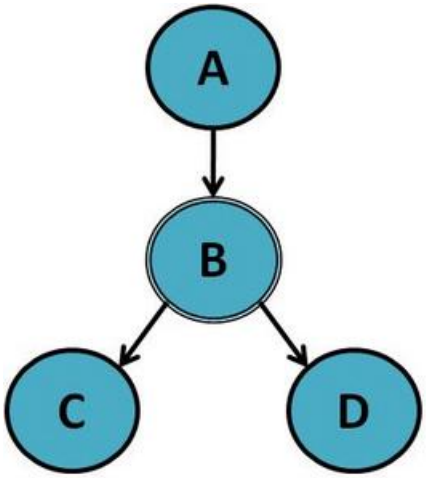
0.1

Your	Score	Explanation

Answer			
0.1	✔	1.00	This is the probability that is reached when following the tree down the appropriate branches.
Total		1.00	

Question 7

Independencies with Deterministic Functions. In the following Bayesian network, the node B is a deterministic function of its parent A. Which of the following is an independence statement that holds the network? You may select 1 or more options (or none of them, if you think none apply).



Your Answer		Score	Explanation
☑ $(C \perp D \mid A)$	✔	0.25	Since B is a deterministic function of A, observing A implies that B also observed, which d-separates C and D. Therefore, $(C \perp D \mid A$
☑ $(A \perp D \mid B)$	✔	0.25	Given B, there is no active trail between A and D therefore, they a conditionally independent.
☐ $(B \perp D \mid C)$	✔	0.25	B is a deterministic function of A, not C, and D is a child of B, so observing C does not make B and D independent.
☐ $(A \perp D \mid C)$	✔	0.25	Since A is an ancestor of both C and D, observing D does not ma A and C independent.
Total		1.00	

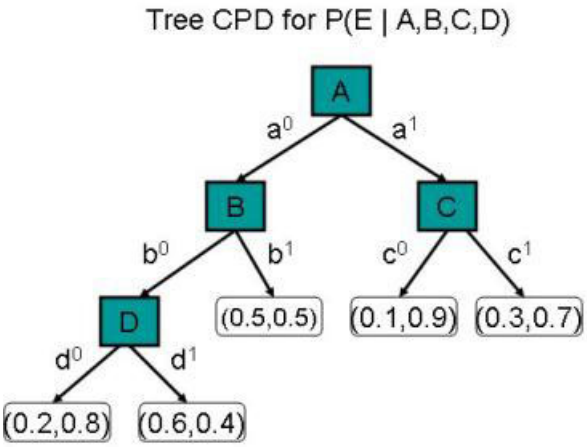
Question 8

Independencies in Bayesian Networks. For the network in the previous question, let B no longer b deterministic function of its parent A. Which of the following is an independence statement that holds the modified Bayesian network? You may select 1 or more options (or none of them, if you think non apply).

Your Answer		Score	Explanation
☐ $(B \perp D \mid A)$	✔	0.25	Since B is the parent of D, B and D do not become independent when A is observed.
☑ $(A \perp D \mid B)$	✔	0.25	The only active trail from A to D passes through B, and there are r V-structures between A and D, so observing B makes A and D independent.
☐ $(A \perp D \mid C)$	✔	0.25	Since C is not on the active trail from A to D, observing C does no make A and D independent.
☐ $(C \perp D \mid A)$	✔	0.25	Since A is not on the active trail from C to D, observing A does no make C and D independent.
Total		1.00	

Question 9

Context-Specific Independencies in Bayesian Networks. Which of the following are context-spec independences that **do** exist in the tree CPD below? (Note: Only consider independencies in this CP ignoring other possible paths in the network that are not shown here. You may select 1 or more optic (or none of them, if you think none apply).



Your Answer		Score	Explanation
☐ $(E \perp_c C \mid b^0, d^0)$	✔	0.25	A variable X is independent of E given conditioning assignmer $\bar{z}$ if all paths consistent with $\bar{z}$ traversed in the tree CPD reach a leaf without querying X. This is not true for this option because is on a separate branch from B and D, and the initial branch is even known since it depends on A.
☐ $(A \perp_c D \mid B)$	✔	0.25	This option is wrong because the tree CPD represents $P(E \mid A, B, C, D)$, so it does not give any information about whether A and D are independent.
☑ $(E \perp_c D \mid b^1)$	✔	0.25	A variable X is independent of E given conditioning assignmer $\bar{z}$ if all paths consistent with $\bar{z}$ traversed in the tree CPD reach a leaf without querying X. This is true for this option.
☑ $(E \perp_c C \mid a^0, b^0)$	✔	0.25	A variable X is independent of E given conditioning assignmer $\bar{z}$ if all paths consistent with $\bar{z}$ traversed in the tree CPD reach a leaf without querying X. This is true for this option.

Total	1.00