Probabilistic Graphical Models

Daphne Koller, Kevin Murphy
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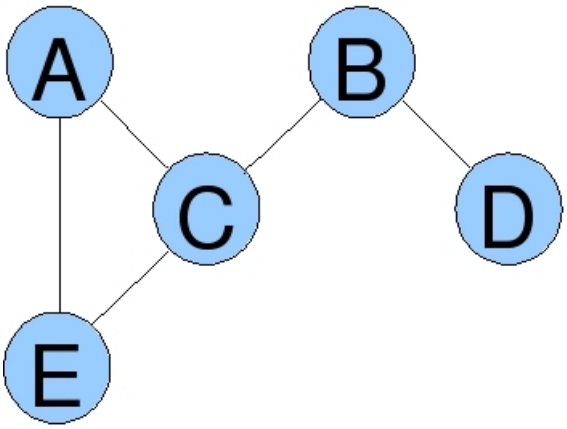
You achieved a score of 7.00 out of 7.00

Question 1

Independence in Markov Networks. Consider this graphical model from week 1's quizzes. This tim of the edges are undirected (see modified graph below). Which pairs of variables are independent in network? You may select 1 or more options (or none of them, if you think none apply).



Your Answer		Score	Explanation
A, B	✔	0.33	There is a path from A to B that goes through C.
C, D	✔	0.33	There is a path connecting C and D that goes through B.
D, E	✔	0.33	There a path connecting D and E that goes through B and C.
Total		1.00	

There is a path from every node to every other node, so none of the nodes are independent.

Question 2

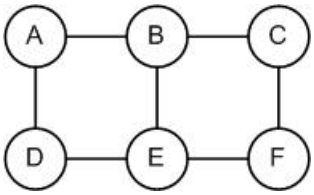
Factor Scope. Let $\phi(c, e)$ be a factor in a graphical model, where c is a value of C and e is a value What is the scope of ϕ?

Your Answer		Score	Explanation
{C, E}	✔	1.00	
Total		1.00	

Question 3

Factorization. Which of the following sets of factors could factorize over the undirected graph below

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



Your Answer		Score	Explanation
☐ $\phi(A,B,D),\phi(C,E,F)$	✔	0.25	The scope of each factor in th set must be a clique in the gra so factors like $\phi(A,B,D)$ car be involved in a factorization c this graph.
☐ $\phi(A,B),\phi(C,D),\phi(E,F)$	✔	0.25	The scope of each factor in th set must be a clique in the gra which is not the case here.
☐ $\phi(A,B,C,D),\phi(C,D,E,F)$	✔	0.25	The scope of each factor in th set must be a clique in the gra so factors like $\phi(A,B,C,D)$ can't be involved in a factoriza over this graph.
☐ $\phi(A,B,C),\phi(A,B),\phi(C,D,E),\phi(E,F),\phi(F)$	✔	0.25	The scope of each factor in th set must be a clique in the gra which is not the case here.
Total		1.00	

Question 4

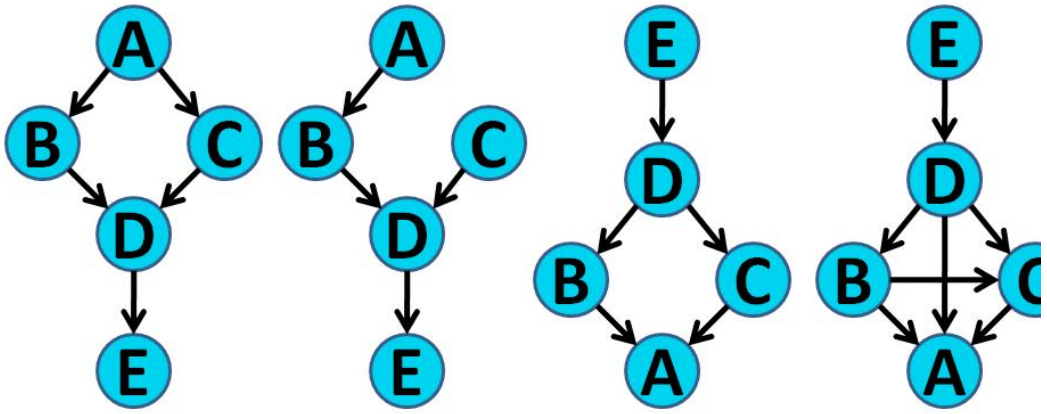
Factors in Markov Network. Let $\pi_1[A,B]$, $\pi_2[B,C]$, and $\pi_3[A,C]$ be all of the factors in a particu undirected graphical model. Then what is $\sum_{A,B,C}\pi_1[A,B]\times\pi_2[B,C]\times\pi_3[A,C]$? More than on answer could be correct.

Your Answer		Score	Explanation
☑ Always equal to the partition function, Z	✔	0.17	This is the forumla for Z, the partition function.
☐ Always equal to 1	✔	0.17	There is no restriction that this sum over possible factor products be 1 (it is not normalized).
☑ Always greater than or equal to 0	✔	0.17	The factors can be any positive function.
☐ Always less than or equal to 1	✔	0.17	There is no restriction that the factors be less than one (it is not normalized).
☑ Always greater than or equal to	✔	0.17	This is the sum over the factor products f

$\pi_1[a,b] \times \pi_2[b,c] \times \pi_3[a,c]$, where a is a value of A, b is a value of B, and c is a value of C			all possible values of the variables in the factors, so it is greater than or equal to th factor product for only one combination o values.
Always less than or equal to $\pi_1[a,b] \times \pi_2[b,c] \times \pi_3[a,c]$, where a is a value of A, b is a value of B, and c is a value of C.	✔	0.17	This is the sum over the factor products f all possible values of the variables in the factors, so it is at least the factor product only one combination of values.
Total		1.00	

Question 5

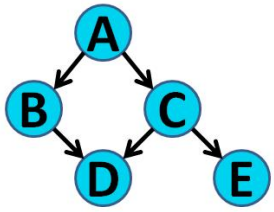
I-Maps. Graph G is a perfect I-map for distribution P, i.e. $\mathcal{I}(G) = \mathcal{I}(P)$. Which of the other graphs is **perfect** I-map for P?



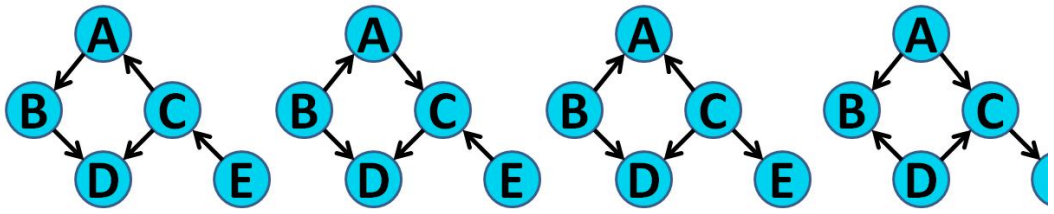
Your Answer		Score	Explanation
None of the above	✔	1.00	I isn't because it has the extra independence $(A \perp C)$. II has the extra independence relation $(B \perp C \mid D)$ (among others). III has no extra independencies but does not preserve an independence relationship in G.
Total		1.00	

Question 6

I-Equivalence. In the figure below, graph G is I-equivalent to which other graph(s)?



G



I II III IV

Your Answer		Score	Explanation
I	✔	1.00	II, III, and IV all have extra independencies.
Total		1.00	

Question 7

***I-Equivalence.** Let T be any directed tree (not a polytree) over n nodes, where $n \geq 1$. A directed tr a traditional tree, where each node has at most one parent and there is only one root, i.e., all but one node has exactly one parent. (In a polytree, nodes may have multiple parents.) How many networks (including itself) are I-equivalent to T?

Your Answer		Score	Explanation
n	✔	1.00	The only graphs that are I-equivalent to T are directed trees with the sam edges and no V-structures. Thus, making a different node the root would make an I-equivalent tree. Any of the tree nodes can be set as the root.
Total		1.00	