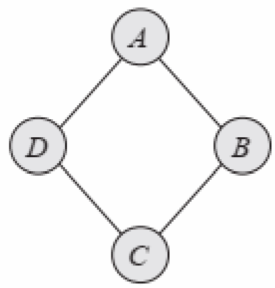
1 Misconception Example:

Consider a scenario where we have four students who get together in pairs to work on the homework for a class. For various reasons, only the following pairs meet: Alice and Bob; Bob and Charles; Charles and Debbie; and Debbie and Alice. (Alice and Charles just can't stand each other, and Bob and Debbie had a relationship that ended badly.) The study pairs are shown in figure a.



(a)

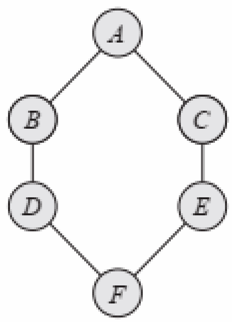
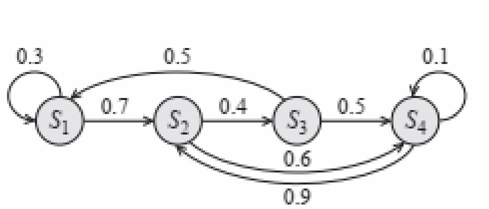
Factors for misconception example are given as follows:

$\phi_1(A, B)$			$\phi_2(B, C)$			$\phi_3(C, D)$			$\phi_4(D, A)$		
a^0	b^0	30	b^0	c^0	100	c^0	d^0	1	d^0	a^0	100
a^0	b^1	5	b^0	c^1	1	c^0	d^1	100	d^0	a^1	1
a^1	b^0	1	b^1	c^0	1	c^1	d^0	100	d^1	a^0	1
a^1	b^1	10	b^1	c^1	100	c^1	d^1	1	d^1	a^1	100
(a)			(b)			(c)			(d)		

2 Vehicle Localization Task Example

Consider a vehicle localization task, where a moving car tries to track its current location using the data obtained from a, possibly faulty, sensor. The system state can be encoded (very simply) using the: Location — the car's current location, Velocity — the car's current velocity, Weather — the current weather, Failure — the failure status of the sensor, and Obs — the current observation. We have one such set of variables for every point t. A joint probability distribution over all of these sets defines a probability distribution over trajectories of the car.

Assume selected X = [L, O}, where L is the location of the object and O its observed location. At first glance, we might be tempted to make the Markov assumption in this setting: after all, the location at time t + 1 does not appear to depend directly on the location at time t − 1. However, assuming the object's motion is coherent, the location at time t + 1 is not independent of the previous locations given only the location at time t, because the previous locations give us information about the object's direction of motion and speed. By adding Velocity, we make the Markov assumption closer to being satisfied. If, however, the driver is more likely to accelerate and decelerate sharply in certain types of weather (say heavy winds), then our V; L model does not satisfy the Markov assumption relative to V; we can, again, make the model more Markovian by adding the Weather variable. Finally, in many cases, a sensor failure at one point is usually accompanied with a sensor failure at nearby time points, rendering nearby Obs variables correlated.

Q. 1.	Using the factors for misconception example, prove that Alice and Bob likely to disagree.	
Q. 2.	Write short note on Markov network for computer vision.	
Q. 3.	Consider a distribution P over four binary random variables X1, X2, X3, X4, which gives probability 1/8 to each of the following eight configurations, and probability zero to all others: (0,0,0,0) (1,0,0,0) (1,1,0,0) (1,1,1,0) (0,0,0,1) (0,0,1,1) (0,1,1,1) (1,1,1,1) Prove that X1 is trivially independent of X3.	
Q. 4.	Consider a non-positive distribution P over four binary variables A, B, C, D that assigns nonzero probability only to cases where all four variables take on exactly the same value; for example, we might have P (a1, b1, c1, d1) = 0.5 and P (a0, b0, c0, d0) = 0:5. Show that Markov network satisfies the Markov blanket condition for all nodes.	
Q. 5.	Write the logarithmic representation of the clique potential parameters for misconception example given above.	
Q. 6.	Find Canonical energy function for the Misconception example.	
Q. 7.	Consider the Markov network structure H of figure a. Construct minimal I-map Bayesian networks for a nonchordal Markov network in Figure a.  (a)	
Q. 8.	Draw DBN for monitoring Vehicle Localization Task given in 2.	
Q. 9.	How monitoring system for vehicle conclude that sensors have failed?	
Q. 10.	Write short note on HMMs and Phylo-HMMs for Gene Finding.	
Q. 11.	Explain State Observation model.	
Q. 12.	The HMM is shown in figure below:  Write distribution for above HMM,	
Q. 13.	Write short note on HMMs for Speech Recognition.	
Q. 14.	Write short note on Linear Dynamical System.	
Q. 15.	Draw single plate model for student example.	