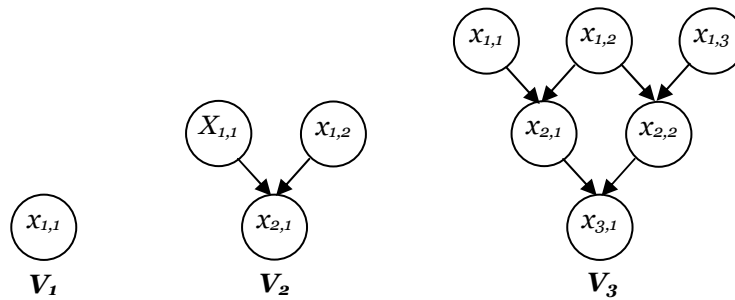


Name:

Student ID#:

Statistical Pattern Recognition (CE-725)
Department of Computer Engineering
Quiz #8 (Bayesian net) - Spring 2012

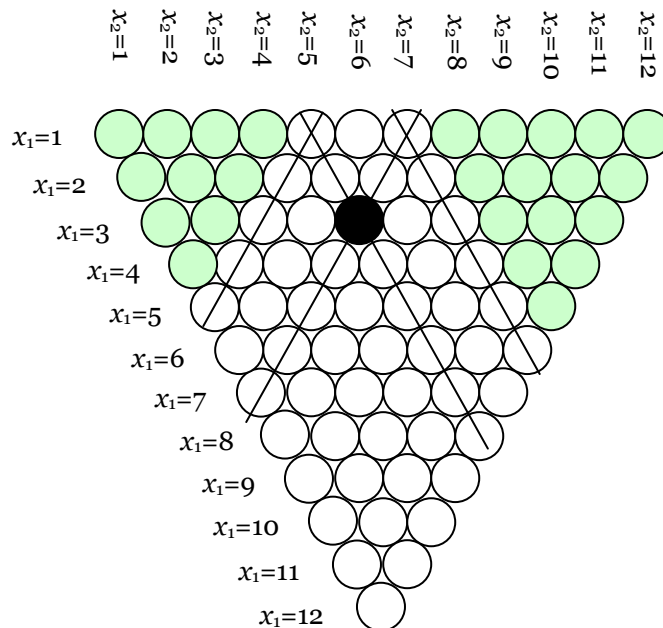
Let V_n be a Bayesian net with nodes $x_{i,j}$ for all $i+j \leq n+1$, where both $i \geq 1$ and $j \geq 1$, and where the parents of $x_{i,j}$ are $x_{i-1,j}$ and $x_{i-1,j+1}$. Nodes $x_{1,j}$ have no parents. V_1 , V_2 , and V_3 are shown below.



a. (50 points) For any V_n , give general conditions in terms of i, j, k , and l that guarantee $x_{i,j}$ independent of $x_{k,l}$ (i.e., $x_{i,j} \perp x_{k,l}$), assuming $i < k$.

Sol:

In general, two nodes are independent (conditioned on nothing) if they are not both descendants of the same node, and neither is a descendant of the other (the green zone in the following figure – $x_{i,j}$ is shown by black background). General conditions which enforce this are $l > j+i-1$ (the right green region in the figure) and $l < j+1-k$ (the left green region in the figure).



In The Name of God, The Compassionate, The Merciful

b. (50 points) For V_n , give conditions in terms of i, j, k , and l that guarantee $x_{i,i} \perp x_{i,j} \mid x_{k,l}$ for $i < j$.

Sol:

$x_{k,l}$ must not be a descendent of both (the green zone in the following figure – $x_{i,i}$ and $x_{i,j}$ are shown by black background). So, either $l < j+1-k$ (the left green region in the figure), or $l > j$ (the right green region in the figure).

