Assig

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Problem 1

Given the local Markov property for UGs,
$X_i \perp\!\!\!\perp X \backslash Cl(X_i, \mathcal{G}) | Ne(X_i, \mathcal{G})$ and $X_i \nsim X_j$
$\Rightarrow X_i \perp\!\!\!\perp X_j \cup (X \backslash Cl(X_i, \mathcal{G}) \cup X_j) | Ne(X_i, \mathcal{G})$
$\Rightarrow X_i \perp\!\!\!\perp X_j | Ne(X_i, \mathcal{G}) \cup (X \backslash Cl(X_i, \mathcal{G}) \cup X_j)$ (by weak union)
$\Rightarrow X_i \perp\!\!\!\perp X_j | Ne(X_i, \mathcal{G}) \cup (X \backslash Ne(X_i, \mathcal{G}) \cup X_i \cup X_j)$
$\Rightarrow X_i \perp\!\!\!\perp X_j | X \backslash (X_i \cup X_j) \Rightarrow X_i \perp\!\!\!\perp X_j | X \backslash \{X_i, X_j\})$
This is the pairwise Markov property. Therefore, we can conclude that local Markov property $\Rightarrow$ pairwise Markov property in undirected graph $\mathcal{G}$.