Bayes networks assignment

SMU

Instructions: You may obtain up to 10 points. You need to justify every single result, i.e. writing down computations, nodes (network) changes, etc. Unjustified answers won't be accepted. Team work is not allowed.

Upload a PDF with your answers to Brute system (deadline is three weeks from publishing the assignment).

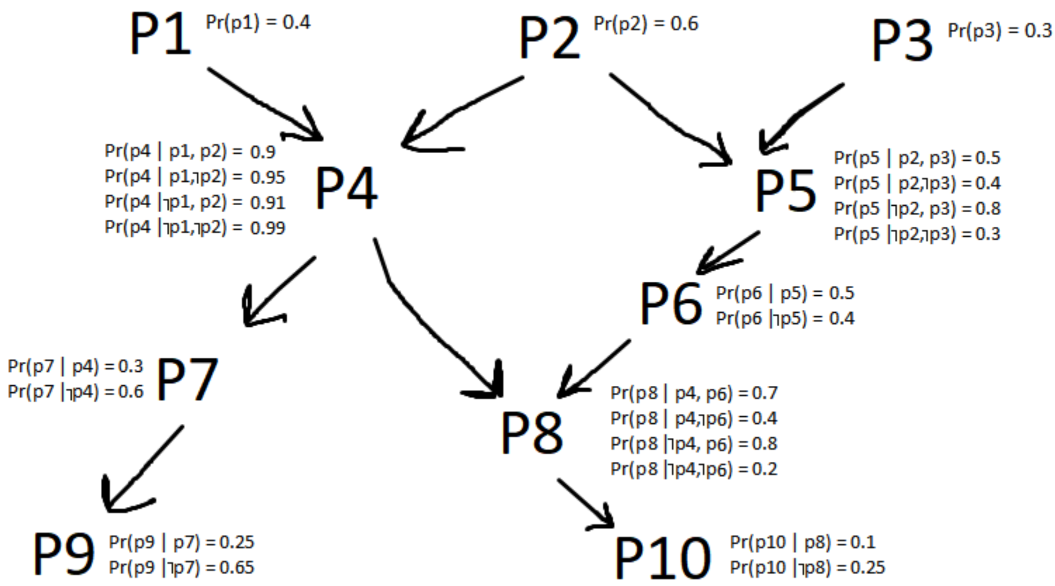

Figure 1: Bayes network

Assignment 1 (3p): Given the Bayes network in Figure 1, list all tuples of maximum X and Y, i.e. sets of random variables, such that $X \perp\!\!\!\perp Y \mid \{ P_6, P_7 \}$.

Assignment 2 (3p): Given the Bayes network in Figure 1, compute

$Pr(p_6)$ with variable order $P_1, P_2, P_3, P_9, P_7, P_4, P_{10}, P_8, P_5, P_6$

$Pr(p_6)$ with variable order $P_7, P_8, P_9, P_{10}, P_5, P_3, P_4, P_1, P_2, P_6$

$Pr(\neg p_4 | p_6)$ with variable order $P_1, P_2, P_3, P_5, P_7, P_8, P_9, P_{10}, P_6, P_4$

$Pr(\neg p_4 | p_6)$ with variable order $P_{10}, P_9, P_8, P_7, P_5, P_3, P_2, P_1, P_4, P_6$

Assignment 3 (3p): Given the Bayes network in Figure 1, and a pseudo random generator producing the following sequence

$$0.1, 0.2, 0.8, 0.3, 0.5, 0.4, 0.6, 0.7, 0.95$$

approximate the probability of $Pr(p_6)$, $Pr(\neg p_4 | p_6)$, and $Pr(p_2 | \neg p_4)$ using three samples (for each probability). Justify the choice of used sampling procedure.

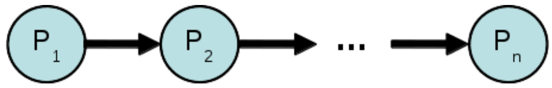

Figure 2: Chain connection of n binary random variables.

Assignment 4 (1p): Analyze the complexity of inference by enumeration and variable elimination on a chain of n binary random variables.