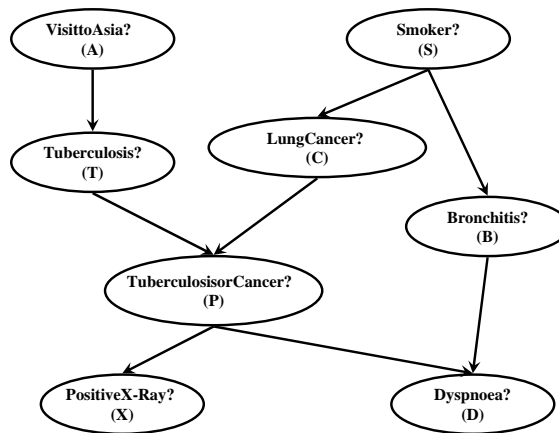


ComS 573 Machine Learning

Problem Set 4

Note: Please do not hesitate to contact the instructor or the TA if you have difficulty understanding or getting started with solving any of the problems.

1. (15 pts.) Consider the following Bayesian network



- (a) (12 pts.) True or false? Please explain.
- $dsep(T, \emptyset, B)$
 - $dsep(A, \{D, C\}, B)$
 - $dsep(A, P, \{X, D\})$
 - $dsep(\{A, X\}, \{P, S\}, \{C, D\})$
- (b) (3 pts.) Express $P(a, s, t, c, p, b, x, d)$ in factored form (the chain rule for BNs).
2. (10 pts.) Give all the DAGs which are independence (d-separation) equivalent to the above DAG.
3. (20 pts.) Jack has three coins C_1 , C_2 , and C_3 with p_1 , p_2 , and p_3 as their corresponding probabilities of landing heads. Jack flips coin C_1 twice and then decides, based on the outcomes, whether to flip coin C_2 or C_3 next: if the two C_1 flips come out the same, Jack flips coin C_2 three times; if the two C_1 flips come out different, Jack flips coin C_3 three times. Given the outcome of Jack's last three flips as: tail, head, tail, we want to know whether his first two flips came out the same. Describe a Bayesian network and a corresponding probabilistic query that answers this question. (You are NOT required to compute the query.)