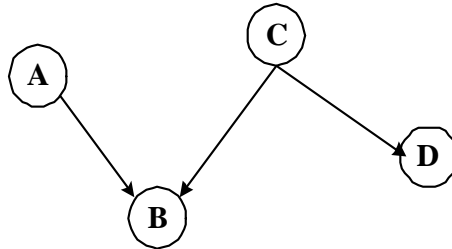


- Consider the following events:
 A = You receive a million dollars;
 B = You receive a utility of 0.2;
 C = You receive a utility of 0.7.

If you are indifferent between A and a lottery between B and C where your chances of winning B are 0.15 and your chances of winning C are 0.85, what is the utility of a million dollars to you?

- Consider the following Bayesian network structure, where A, B, C and D are boolean variables: a) Is A independent of D?



- Is A independent of D given B?
- Is A independent of D given C?
- Suppose you are given the following set of training examples:

A	B	C	D
0	1	0	1
0	?	1	1
1	0	0	0
1	0	1	?
0	0	?	1

Show the sequence of filled-in values and parameters produced by the EM algorithm, assuming the parameters are initialized by ignoring missing values.

- Representing the following boolean functions using:
 - decision trees;
 - neural networks: show the structure of the network and the weights on the edges.

(a) $A \wedge \neg B$

(b) $A \vee [B \wedge C]$

(c) $A \text{ XOR } B$

4. Suppose we want to classify a given ball into one of these three classes: {H,M, L}, based on three attributes: the color of the ball({Y, R, P}), the size of the ball({L,S}), and the price of the ball({C1, C2, C3}). Build a decision tree to learn the classification, choosing the best attribute at each step according to information gain.

Price	Color	Size	Class
C1	Y	L	M
C2	Y	S	H
C2	R	L	L
C3	R	S	M
C3	P	L	H
C1	P	S	H

5. Consider the learning approaches we've learned in class, which might be the best in the following cases:

1. there are 13 examples in the training set, each is a vector of six continuous value, the attributes are tight-connected;
2. 1000-dimension instance space, the attribute values are independent given the classifications, and are normal distributed;
3. training set of size 10000, the attributes are loosely connected.

6. What is the "curse of dimensionality"? Explain two approaches to select "best" features. What is the asymptotic time complexity of them for nearest-neighbor as a function of the number of training anvalidation examples and the number of attributes?