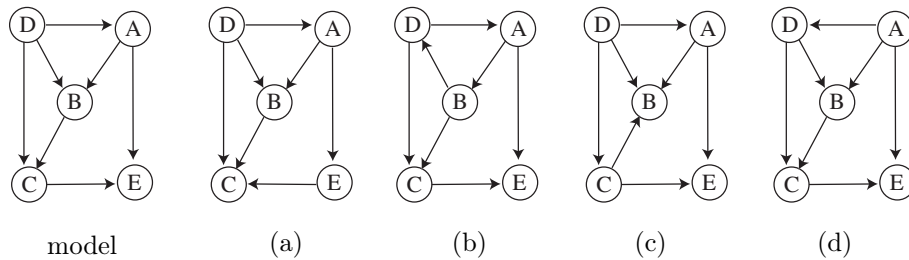


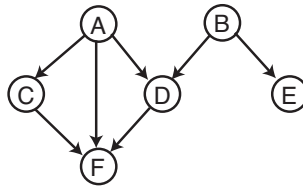
582481 Causal analysis  
Exercises #5  
7.10.2008

5.1 Let  $A$  and  $B$  be the results of two independent coin tosses, and let  $C$  be a bell which rings whenever  $A$  and  $B$  are both heads or both tails. Is the distribution  $P(a, b, c)$  stable (faithful) with respect to the generating process?

5.2 Which of the following graphs (a-d) are d-separation-equivalent DAGs with the model DAG on the left?



5.3 We observe data from a distribution  $P$  which is stable with respect to the network below. Assuming that our independence tests are reliable, simulate the running of the IC algorithm on this data. Be careful to write down all the intermediate steps. What is the end result of the algorithm? Draw all the DAGs which the resulting pattern represents.



5.4 We observe sample data over three variables  $X$ ,  $Y$ , and  $Z$ . Below is a summary of the data, in the form of a matrix of counts. Perform a chi-square test for the conditional independence of  $X$  and  $Y$  given  $Z$ . Can we reject the null hypothesis (independence) at  $P < 0.05$ ?

|          |                 |    |    |    |
|----------|-----------------|----|----|----|
| $Z = 0:$ | $X \setminus Y$ | 0  | 1  | 2  |
|          | 0               | 21 | 15 | 29 |
|          | 1               | 31 | 22 | 53 |

|          |                 |    |    |    |
|----------|-----------------|----|----|----|
| $Z = 1:$ | $X \setminus Y$ | 0  | 1  | 2  |
|          | 0               | 30 | 54 | 13 |
|          | 1               | 13 | 30 | 9  |