Data driven Business analytics – MGT-302

Homework 2 - Problem 4. Causal inference [15]

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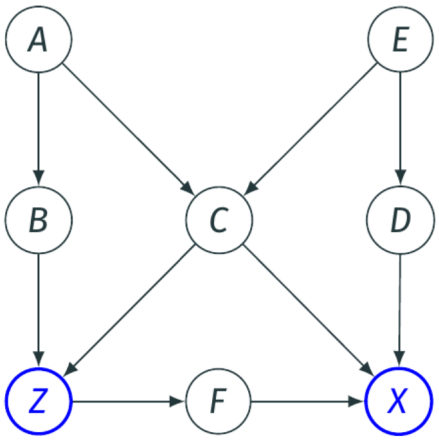

Figure 1: A direct acyclic graph.

1 Find a subset of variables that d-separates Z from X.

A set K d-separates Z from X is and only if K blocks every path from X to X. So we can choose $\{ABFZ\}$, A, B and F are chosen because they each block thee causal paths A->B->Z, B->Z->F->X and Z->F->X, respectively. And Z is chosen because it is one of the variables we want to d-separate.

2 Find two different valid adjustment sets for the ordered pair (Z,X), i.e., for computing $P_{do}(Z = z)(X)$.

Two valid adjustment sets for the pair (Z,X) are $\{A,E\}$ and $\{B,C\}$. The first set, $\{A,E\}$, is valid because A blocks the paths Z<-B<-A->C->X, E blocks Z<-C<-E->D->X, and A and E will block all the backward paths for X and Z. The second set, $\{B,C\}$, is valid because B blocks Z<-B->Z->F->X, C blocks Z<-C->X, and B and C will block all the backward paths for X and Z.

3 What are all the edges that one can modify in the graph so that the modified graph stays in the same Markov equivalence class?

There are 5 possible modifications we can do without modifying the Markov Equivalency class; reverse the edge between $\{A,B\}$, $\{C,X\}$, $\{Z,F\}$ or $\{E,D\}$. The fifth is the following reverse $\{B,Z\}$ and $\{C,Z\}$.