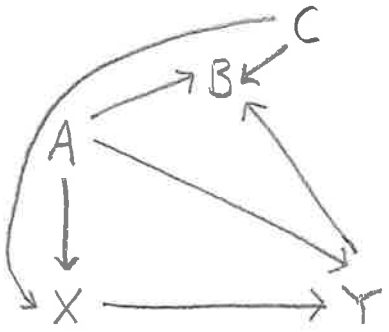
Homework #2

1 [a] In the Figure on the right, what set of variables is sufficient for adjustment to estimate $P(y|\hat{x})$?



[b] Give an expression for $P(y|\hat{x})$ without "hats" (observable data only). Derive using (1) the rules of do Calculus, (2) the backdoor theorem.

[c] Write the necessary ignorability assumption for identifying $P(y|\hat{x})$ in terms of potential outcomes. (Assume X only takes on the values 0 and 1.)

[d] Given the necessary ignorability assumption and consistency, derive an expression for the average causal effect of X on Y using potential outcomes notation.

[e] Now suppose you have to condition on B. What set of variables is sufficient now to estimate $P(y|\hat{x})$? Derive an expression for $P(y|\hat{x})$.

[g] Translate the Figure above to a single world intervention graph and show how the necessary ignorability assumptions result from the SWIG.