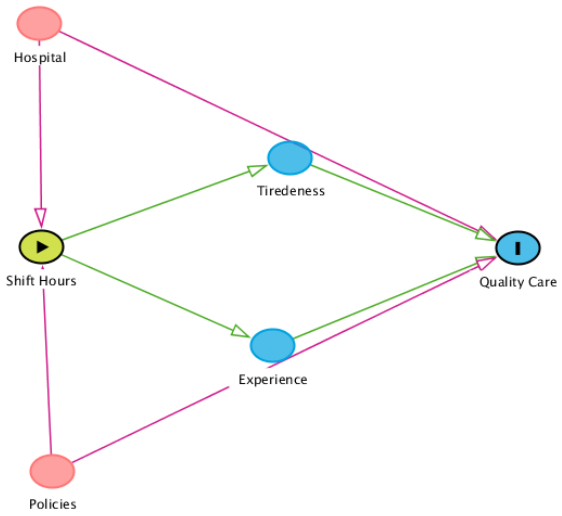
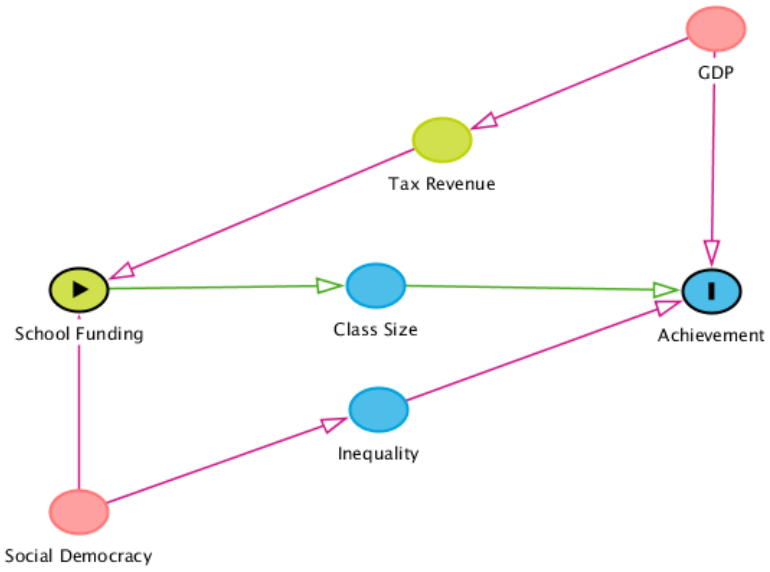
Homework for Chapter 7: Drawing Causal Diagrams

1. You are making a simplified causal diagram to represent the data-generating process of viewership for a TV show. Which of the following is true?
    a. **The diagram should include a variable for the "number of celebrities in the cast"**
    b. The diagram should contain one variable for "show airs in the evening" and another for "show doesn't air in the evening"
    c. The diagram should not contain a variable for "show budget" because budgets are often secret and the researcher can't measure them
    d. The diagram should contain the variable "review score in the Jefferson Weekly," which is the newspaper published by the students at Jefferson High School, with a readership of about 120 people.
2. Draw a causal diagram for the research question "do long shift hours make doctors give lower-quality care?" that incorporates the following features (and only the following features):
    a. Long shift hours affect both how tired doctors are, and how much experience they have, both of which affect the quality of care
    b. How long shifts are is often decided by the hospital the doctor works at. There are plenty of other things about a given hospital that also affects the quality of care, like its funding level, how crowded it is, and so on
    c. New policies that reduce shift times may be implemented at the same time (with the timing determined by some unobservable change in policy preferences) as other policies that also attempt to improve the quality of care



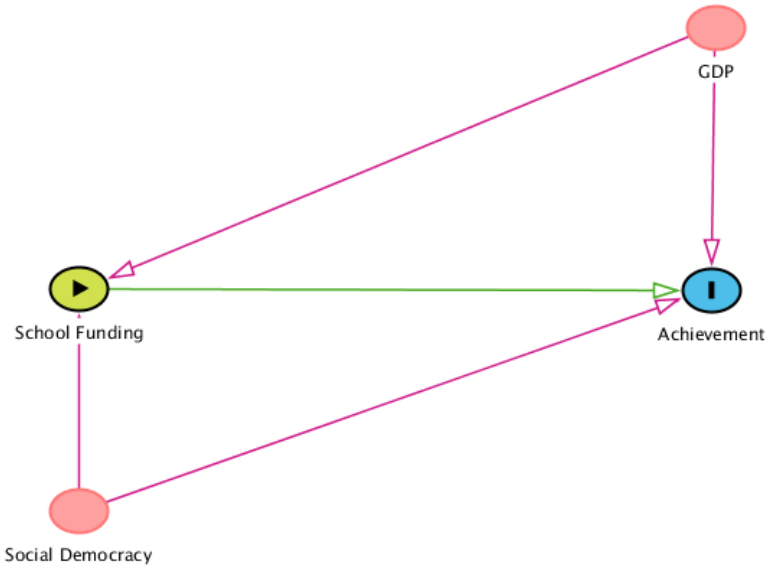

3. Consider this research question: Does the funding level of public schools affect student achievement for students in your country?
    a. What is the treatment and what is the outcome of interest?
        i. Treatment: Funding level of public schools.
        ii. Outcome: student achievement.

b. Write down a list of relevant variables.
    i. Tax revenue, GDP, class size, social democracy.
c. Which of the variables in your list in part b are causes of both treatment and outcome?
    i. Social democracy: democratic systems with a strong focus on social policies might have higher public school funding and higher achievement. The latter would happen through some mediator, such as reducing inequality, and giving the children of poor families better chances in the educational system.
    ii. GDP: can influence school achievement through the economic situation of the families the children grow up in. It can also affect funding through tax revenue.
d. Why might we want to pay extra attention to the variables listed in part c?
    i. Because these are confounders.
e. Draw a causal diagram of the variables listed in part b.



f. Simplify the diagram from part e.

i. We can remove all the mediators from the graph.




4. Describe the kinds of situations that each of the following could be applied to simplify a causal diagram.

a. Unimportance. Based on our scientific knowledge to assume some variable has a very tiny effect on our outcome so we can just drop it.

b. Redundancy. When two variables have the same arrows coming in and out we can drop one of them.

c. Mediators. Because if we are just interested in the total effect of X on Y the mediators between these two are not important.

d. Irrelevance. If the variable is not in any path between X and Y we might want to drop it.

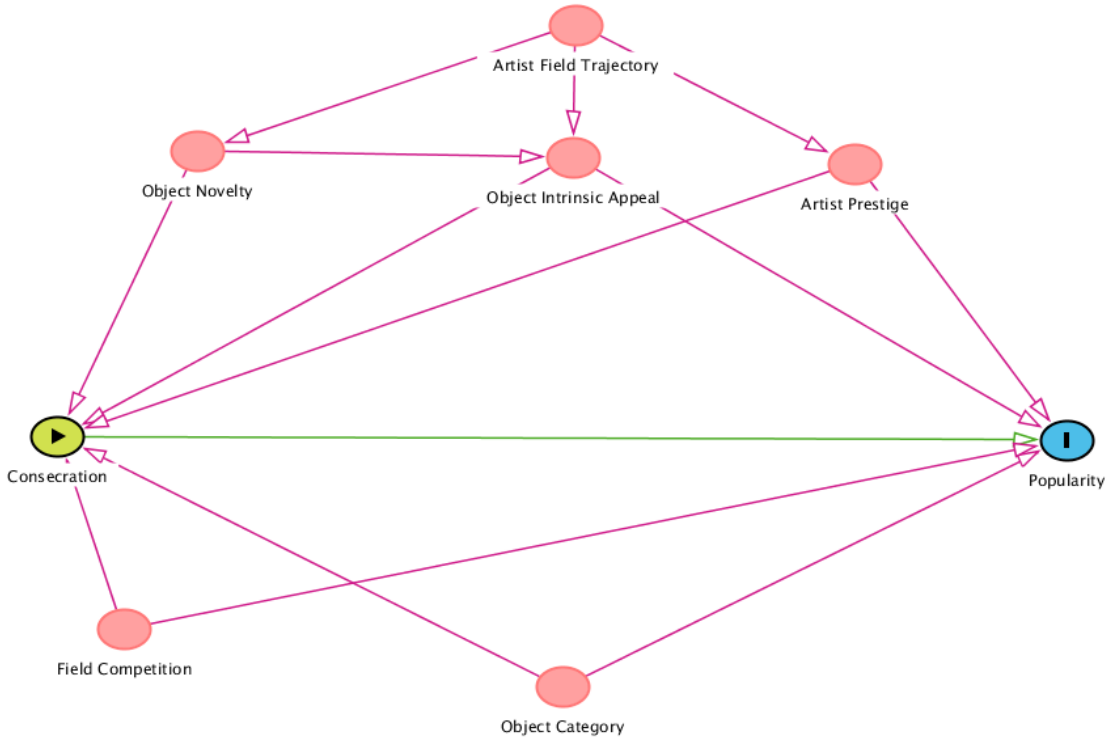
5. How can a causal diagram be modified to avoid cyclic relationships?

   There are two strategies. (1) We can include a time dimension. For instance, X_t0 can cause Y_t0, then Y_t0 causes X_t1, and so forth. The other strategy is to find some other variable that causes variation in one of the variables in the cycle but not the other. For instance, quality and success form a cycle. Better researchers gain prestige and prestige grants opportunities for further success. But if we argue that some prizes are given independent of quality (at random) then we can estimate how winning the price (success) which is random, affects quality later on.

6. Think of a research question in your field of interest

What is the effect of consecration on the popularity of cultural objects?

   a. What is the cause variable and what is the outcome variable?
      i. The treatment is consecration, the outcome is popularity.
   b. Write down a list of between 5 and 10 relevant variables in the data-generating process.
      i. Measured at the level of the object:
         1. It's quality (i.e. intrinsic appeal).
         2. The categories it fits in.
         3. Novelty.
      ii. Measured for the producer of the object.
         1. Prestige.
         2. The trajectory of the artists in the field.
      iii. Measured at the level of the field:
         1. Level of competition.
   c. Draw a causal diagram incorporating all the variables from part b.




d. Stop working on this problem for fifteen minutes and do something else. Then come back, look at your causal diagram from part c again, and describe one bad assumption you think it made, or something it left out.

   i. There are probably two mediators through which consecration can affect popularity. One is audience size and the other is object appeal. Consecration might increase audience size, but it might decrease the appeal of the object (for instance if its value as a distinction marker decreases when it becomes "mainstream"). Thus, both paths should go in the model since otherwise, we might estimate a null effect when in fact there might be both a positive and a negative effect of consecration on popularity.

e. Consider the diagram below. It depicts a cyclical relationship between student achievement and motivation. If students achieve more (i.e., score well on exams), then their motivation goes up, and if their motivation goes up, they achieve more. Change the diagram so that the relationship is not cyclic anymore.

   i. If we introduce exam difficulty as a random variation in achievement then we can estimate brake the cycle.