

Sample Question on the Logic of Causal Order

Richard Williams, University of Notre Dame, <https://www3.nd.edu/~rwilliam/>

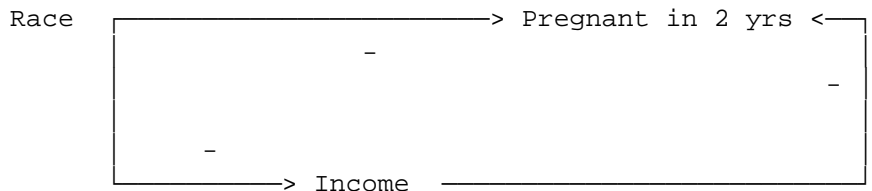
Last revised February 15, 2015

A researcher is interested in the relationship between race, income, and the likelihood of getting pregnant within the next two years. For each of the following models, indicate which individual would be more likely to get pregnant. Your options are: Sue is more likely to get pregnant; Jane is more likely to get pregnant; Sue and Jane are equally likely to get pregnant; or DK, don't know, not enough information. (Note: Race is coded 1 = black, 0 = white; all three models agree that blacks tend to have lower incomes than whites.)

	Sue	Jane	Fig 1	Fig 2	Fig 3
1.	Black	White	a.	b.	c.
2.	Black Wealthy	Poor White	d.	e.	f.
3.	Black Poor	White Wealthy	g.	h.	i.
4.	Black Wealthy	Wealthy White	j.	k.	l.
5.	Poor	Wealthy	m.	n.	o.
6.	Wealthy	Wealthy White	p.	q.	r.

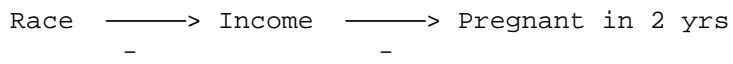
=====

Figure 1.



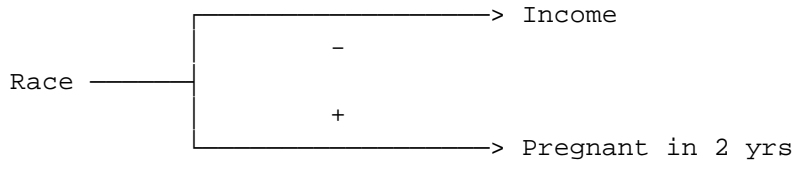
=====

Figure 2.



=====

Figure 3.



Answers. First, some hints:

✓ It is sometimes helpful to relabel variables so their meanings are more intuitive. For example, it would probably be easier to interpret the effects of "Race" if the variable were instead labeled "Black."

✓ When the value of only one of the independent variables is given, it is often helpful if you first logically deduce the relative position of the two sides on the other independent variable. For example, in problem (a), the black is more likely to have a low income than is the white. [NOTE: We would not say that the black is likely to have a low income, it is just that a black is more likely to have a low income than is a white.]

✓ For each independent variable, determine whether Sue or Jane has the edge, or whether neither does. Neither would have the edge if (1) both had the same value on the variable, or (2) the variable was irrelevant because it did not directly affect the dependent variable and the values of variables which did have direct effects were known. (This could occur if the variable only had indirect effects, or if its relationship with the dependent variable was spurious.)

a. **DK.** A black is more likely to have a low income than is a white, so we can treat this the same as a Black Poor vs. White Wealthy contrast. According to the model, when all other things are equal, Blacks are less likely to get pregnant than are whites (which favors Jane) but Poor people are more likely to get pregnant than are wealthy people (which favors Sue). Since the effects of race and income work in opposite directions here, and we don't know the relative importance of each, we conclude that we don't know which individual is more likely to get pregnant.

b. **Sue** According to the model, Blacks tend to have lower incomes, and those with lower incomes are more likely to get pregnant.

c. **Sue** Blacks are more likely to get pregnant than are whites. Since race is known and it is the only direct determinant of pregnancy, the value of income is irrelevant.

d. **Jane** When all other things are equal, Blacks have fewer pregnancies than do whites, and wealthy people have fewer pregnancies than do poor people.

e. **Jane** Wealthy people have fewer pregnancies than do poor people. Given that income is known and only it directly affects pregnancy, knowledge of race is irrelevant.

f. **Sue** Blacks have more pregnancies than do whites. Given that race is known and that race is the only direct determinant of pregnancy, knowledge of income is irrelevant.

g,h,i. Using the same reasoning as in (a), (b), and (c), the answers are **DK, Sue, Sue**

j. **Jane** Blacks are less likely to get pregnant than are whites. The effect of income is not important since both Sue and Jane are wealthy.

k. =. Income is the only direct determinant of pregnancy, and both Sue and Jane are wealthy. Since Income is known, the value of race is irrelevant.

l. **Sue** Race is the only direct determinant of pregnancy; income is irrelevant.

m,n,o. Note that, according to all three models, Poor people are more likely to be black than are wealthy people, so we can treat this the same as a Poor Black vs. Wealthy White contrast. Using the same logic as in (g), (h), and (i) and (a), (b), (c) the answers are **DK, Sue, Sue**

p,q,r. This is tricky! It is tempting to just assume that Sue is white, and that the two are therefore equally likely to get pregnant. But, we know that Jane is definitely white, while there is at least a small chance that Sue is Black. Therefore, when comparing the two, we should treat Sue as though she were a wealthy black. This case was discussed in problems (j), (k), and (l), so the answers are **Jane, =, Sue.**