

**Psychology 204b (Causal Modeling) Simonton Winter 2008**

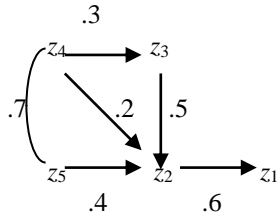
Exam III

Your Name \_\_\_\_\_.

**Recursive Model**

Assume below that all variables have been standardized to a zero mean and a standard deviation of unity (i.e., z scores). 100 points total.

Suppose that the following is a true causal model according to extremely solid theory and data (N.B.: a “curved arrow” connects  $z_4$  and  $z_5$ ).



Then do the following:

1) Reconstruct the entire correlation matrix (to two decimal places) by decomposing each correlation as a function of path coefficients and then carrying out the requisite arithmetic. Please show all work. (10 points, 1 per correlation)

$r_{12} =$

$r_{13} =$

$r_{14} =$

$r_{15} =$

$r_{23} =$

$r_{24} =$

$r_{25} =$

$r_{34} =$

$r_{35} =$

$r_{45} =$

2) In the above decompositions, indicate which paths represent direct effects, which indirect effects, which spurious relations, and which other noncausal relations? (10 points; 1 per correlation)

- 3) Calculate the path coefficients for all residual effects (the  $U$ 's) in the above causal model using the formula for computing the  $R^2$  from the  $p$ 's and  $r$ 's (using the  $r$ 's that you computed on the first page). (10 points; 2 points for  $z_3$  and 4 points each for  $z_1$  and  $z_2$ )
- 4) Translate the path diagram given above into a set of structural equations, substituting the given and calculated values for all path coefficients. Be sure to include the specifications that show that this is a recursive model (i.e., what must be uncorrelated). (10 points; 3 points each for  $z_1$  and  $z_2$ , 1 point for  $z_3$ , and 3 points for the rest of the diagram)
- 5) Take the structural equation for variable  $z_1$ , multiply all terms on both sides of the equation by  $z_4$ , add across all cases, and divide by  $n$ . What results once each term is interpreted? (8 points). What procedure would yield exactly the same outcome? (2 points)
- 6) Suppose that even though the above model is correct, the researcher had incorrectly drawn a causal arrow from  $z_3$  to  $z_1$ . Estimate the new path coefficient  $p_{13}$  using the formula for the standardized partial regression coefficient in the two-independent variable case. What does the resulting number tell us? (10 points)
- 7) Suppose that even though the above model is correct, the researcher had incorrectly left out the causal arrow from  $z_4$  to  $z_2$ . Do the calculations showing how this error can be detected. (10 points)
- 8) How would the model be tested using the hierarchical regression method? List the specific regression analyses that would be conducted (i.e., the restricted and unrestricted models for each endogenous variable). (10 points)
- 9) Show how changes in  $z_4$  affect  $z_1$  through all possible paths (direct and indirect), that is, the total effect of the former variable on the latter variable. (10 points)
- 10) How do we know that the model is probably overidentified? How many overidentifying restrictions are there likely to be? Provide at least one overidentifying restriction. (Hint: You already did the main work for this question in an earlier question.) (10 points; 4 for the first question, 4 for the second, and 2 for fulfilling the third request)