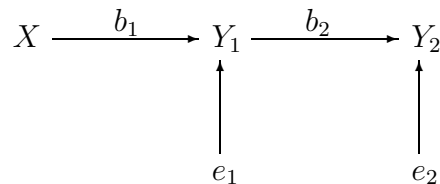


STA 313F2004 Assignment 4

Do this assignment in preparation for the quiz on Friday, Nov. 5. The hand-written parts are practice for the quiz, and are not to be handed in. The computer part (last two questions) may be handed in, so bring your printouts to the quiz.

1. Consider the model $y = b_1x_1 + b_2x_2 + e$, where $x_1 \sim N(0, \sigma_1^2)$, $x_2 \sim N(0, \sigma_2^2)$, $Cov(x_1, x_2) = \sigma_{12}$, $e \sim N(0, \sigma_e^2)$, and e is independent of x_1 and x_2 .
 - (a) Draw a path diagram.
 - (b) What is the parameter θ ? It has 6 elements.
 - (c) Is this model saturated? Answer Yes or No.
 - (d) Classify the variables in a two-by-two table as either Exogenous or Endogenous, and either Manifest or Latent.
 - (e) What is the joint distribution of the manifest variables? Express the variance-covariance matrix in terms of the parameter θ ; show your work. Each cell in your matrix should contain a formula for the variance or covariance in terms of quantities like σ_1^2 , σ_2^2 , b_1 and so on.
2. Consider this model:



- (a) Express the model as a set of equations. Give standard distributional assumptions. Make up your own symbols for parameters when necessary.
 - (b) What is the parameter θ ? It has 5 elements.
 - (c) Is this model saturated? Answer Yes or No.
 - (d) Classify the variables in a two-by-two table as either Exogenous or Endogenous, and either Manifest or Latent.
 - (e) What is the joint distribution of the manifest variables? Express the variance-covariance matrix in terms of the parameter θ ; show your work. Each cell in your matrix should contain a formula for the variance or covariance in terms of quantities like σ_x^2 , b_1 and so on.
3. Using the data in `chain3.dat` (see course Web page for link), write an S program to test $H_0 : b_1 = b_2 = 0$. Your output should include G , the degrees of freedom, and the p -value as well as the MLEs for both the restricted and the unrestricted model. You may use my function `mvnLL`; see course Web page for link. Bring a printout listing your program and illustrating the run on `chain3.dat`.

Warning These data do not have actually have mean zero, and this is typical of most real data sets. The function `mvnLL`, like `proc calis`, handles the situation automatically. But if you use regression to get starting values for b_1 and b_2 , you should remember to subtract off the mean of each variable first.

4. Now do the same thing with `proc calis`. You should get the same G value. Bring both your log file and your list file to the quiz.