

Name Jenny

Student Number _____

STA 431s2017 Quiz 4

1. This question is based on the SAS part of your homework. *Answer based only on proc calis output.*

(a) (1 point) What is the estimated intercept? **Write the number in the space below.** On the printout, circle the number and write "Question 1a" beside it.

9.13675

(b) (2 points) You want to know whether, controlling for Quiz average and average on the computer assignment, score on the Midterm is related to score on the final exam. What is the value of the test statistic? It's labelled "t Value," but it's actually a Z. **Write the number in the space below.** On the printout, circle the number and write "Question 1b" beside it.

2.4285

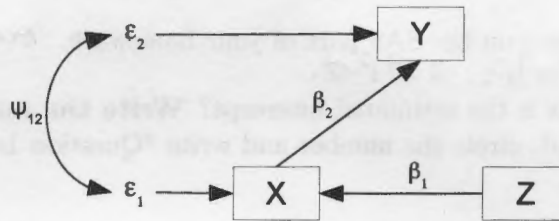
(c) (1 point) What is the estimated variance of the computer scores? **Write the number in the space below.** On the printout, circle the number and write "Question 1c" beside it.

1.32414

2. (6 points) For a simple instrumental variables model, the model equations are

$$\begin{aligned} X_i &= \alpha_1 + \beta_1 Z_i + \epsilon_{i1} \\ Y_i &= \alpha_2 + \beta_2 X_i + \epsilon_{i2}, \end{aligned}$$

where $E(Z_i) = \mu_z$, $\text{Var}(Z_i) = \sigma_z^2$, $E(\epsilon_{i1}) = E(\epsilon_{i2}) = 0$, $\text{Var}(\epsilon_{i1}) = \psi_1$, $\text{Var}(\epsilon_{i2}) = \psi_2$ and $\text{Cov}(\epsilon_{i1}, \epsilon_{i2}) = \psi_{12}$. The path diagram is



You don't have to calculate all the moments of the observable data, just the ones you need. Denoting $\text{cov}(Z_i, X_i, Y_i)^\top$ by $\Sigma = [\sigma_{ij}]$,

(a) Calculate $\sigma_{12} = \text{Cov}(Z_i, X_i)$. Show a little work and **circle your answer**.

$$\begin{aligned} \sigma_{12} &= \text{Cov}(Z_i, X_i) = E(\tilde{Z}_i, \tilde{X}_i) = E(\tilde{Z}_i, (\beta_1 \tilde{Z}_i + \epsilon_{i1})) \\ &= \beta_1 E(\tilde{Z}_i^2) + E(\tilde{Z}_i) E(\epsilon_{i1}) = \beta_1 \sigma_z^2 \end{aligned}$$

(b) Calculate $\sigma_{13} = \text{Cov}(Z_i, Y_i)$. Show a little work and **circle your answer**.

$$\begin{aligned} \sigma_{13} &= \text{Cov}(Z_i, Y_i) = E(\tilde{Z}_i, (\beta_2 \tilde{X}_i + \epsilon_{i2})) \\ &= \beta_2 E(\tilde{Z}_i, \tilde{X}_i) + E(\tilde{Z}_i) E(\epsilon_{i2}) \\ &= \beta_2 \beta_1 \sigma_z^2 \end{aligned}$$

(c) Give the formula for a Method of Moments estimate of the ~~coefficient~~ parameter β_2 in terms of $\hat{\sigma}_{ij}$ values. **Circle your answer**.

$$\hat{\beta}_2 = \frac{\hat{\sigma}_{13}}{\hat{\sigma}_{12}}$$

Please attach **both** your log file and your output file. Make sure your name appears on both documents. Attach the *log file*, not just a listing of the SAS program.