

**I: Matrices**

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(a) Let  $X = \begin{bmatrix} 0 \\ 1 \\ 3 \end{bmatrix}$  and  $Y = \begin{bmatrix} 3 \\ 1 \\ 3 \end{bmatrix}$

(b) What is  $X'$ ? What is  $Y'$ ?

(c) Compute  $X'Y$

(d) Let  $M = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  and  $X = \begin{bmatrix} 0 \\ 1 \\ 3 \end{bmatrix}$ . Compute  $MX'$

(e) Let  $M = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$  Compute  $M^{-1}$ .

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**II: The unbiasedness of the OLS estimator**

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(1) Simple regression without constant

(a) Write down the formula of the OLS estimator

(b) Calculate the expected value of this estimator

(2) Repeat the exercise with the case of simple regression with constant

(3) Repeat the exercise with the case of multiple regression without constant

(4) Repeat the exercise with the case of multiple regression with constant