**Matrix quiz**

For a given *n*×*p* matrix **X** with *r*(**X**)<*p*, answer the following for each matrix quantity. Consider **Lβ** that is estimable. For starters, we know that the M-P inverse **X+** has dimension *p*×*n* and it is unique; **X–** is a conditional inverse of **X**, also is *p*×*n*, and is not unique. We also know that  is symmetric, idempotent, and invariant to choice of .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Matrix quantity | Another name? (Or its importance?) | Dimension | Invariant to choice of ? | Other properties |
|  |  | p×n | No | This is a g-inverse of **X** for any g-inverse of **X***t***X** |
|  |  | p×1 | No |  |
|  | **L** | 1×1 | Yes\* | Unbiased estimator for  **L** |
|  | **Yt(I–PX)Y** (numerator of MSE) | 1×1 | Yes | Proportional to χ2 |
|  | Multiply by MSE to get estimated Var(**L**) | 1×1 | Yes\* |  |
| **PX** | Projection matrix | n×n | Yes |  |
| **PXY** | Predicted values | n×1 | Yes |  |
|  | **H** matrix; used to test for estimability | p×p | No |  |

\*This holds since **Lβ** is estimable; i.e., there exists a vector **a** such that **L**=**a***t***X**.