

Q1.8

$$A^T A = (\mathbf{I} - 2\mathbf{u}\mathbf{u}^T)^T (\mathbf{I} - 2\mathbf{u}\mathbf{u}^T)$$

$$= (\mathbf{I} - 2(\mathbf{u}\mathbf{u}^T)^T) (\mathbf{I} - 2\mathbf{u}\mathbf{u}^T)$$

$$= (\mathbf{I} - 2\mathbf{u}\mathbf{u}^T) (\mathbf{I} - 2\mathbf{u}\mathbf{u}^T)$$

$$= \mathbf{I} - 4\mathbf{u}\mathbf{u}^T + 4\alpha(\mathbf{u}^T, \mathbf{u})\mathbf{u}^T$$

$$= \mathbf{I} - 4\mathbf{u}\mathbf{u}^T + 4\alpha\mathbf{u}^T$$

$$= \mathbf{I}.$$