

Additional Notes and Solution Manual For: Matrix Computations: Third Edition by Gene H. Golub and Charles F. Van Loan

John L. Weatherwax*

February 9, 2007

Chapter 2 (Matrix Analysis):

Basic Ideas from Linear Algebra

P 2.1.1 (existence of a p rank factorization of A)

Assume A is $m \times n$ and of rank r . The using elementary elimination matrices we can reduce A to its row reduced echelon form R , given by $E_1 A = R$ or $A = E_1^{-1} R = E_2 R$. In this reduction E_2 is $m \times m$ and R is $m \times n$. Because R has $n - r$ zero rows we can block decompose it as follows

$$R = \begin{bmatrix} \hat{R}_{r \times n} \\ 0_{m-r \times n} \end{bmatrix}$$

where we have listed the dimensions of the the block matrices next to them. Now $\hat{R}$ is of rank r . In addition, block decomposing E_2 as

$$E_2 = \begin{bmatrix} \hat{E}_{m \times r} & \hat{E}_{m \times m-r} \end{bmatrix}.$$

Now since E_2 is of rank m the first r columns of E_2 is a matrix of rank r . This block decomposition gives for A the expression

$$A = \begin{bmatrix} \hat{E} & \hat{E} \end{bmatrix} \begin{bmatrix} \hat{R} \\ 0 \end{bmatrix} = \hat{E} \hat{R}$$

This gives the decomposition of A into $\hat{E}$ of size $m \times r$ and $\hat{R}$ of size $r \times n$ each of rank r , thus proving the decomposition.

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Golub And Van Loan Solution Manual

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web jan 24 2022 daily this runner consumes carbohydrates 35 of total daily fuel these carbohydrates are a mix that includes run of the mill carbs such as bread and oatmeal dairy such as yogurt and milk and fruit such as berries and bananas protein 35 of total daily fuel healthy fats 15 of total daily fuel