Week7

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1 QBUSS1040 Week 7 Outline

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Outline:

1. Block Matrix (Problem 4)
2. Matrix multiplication
    - Definition
    - Properties, Proof and Complexity (Problem 3)
    - Coding (Problem 1)
3. QR Factorization (Problem 2)
    - Review
    - Coding

1.1 Matrix multiplication

Definition
$AB = C$

1. Dimension check
2. $$C_{i,j} = \text{inner}(\ ,\ ) = \sum \tag{1}$$
3. Column and row interpretation (optional)
4. Coding

Properties of matrix multiplication 1. Associativity

$$(AB)C = A(BC) \tag{2}$$

2. Associativity with scalar multiplication

$$\gamma(AB) = (\gamma A)B \tag{3}$$

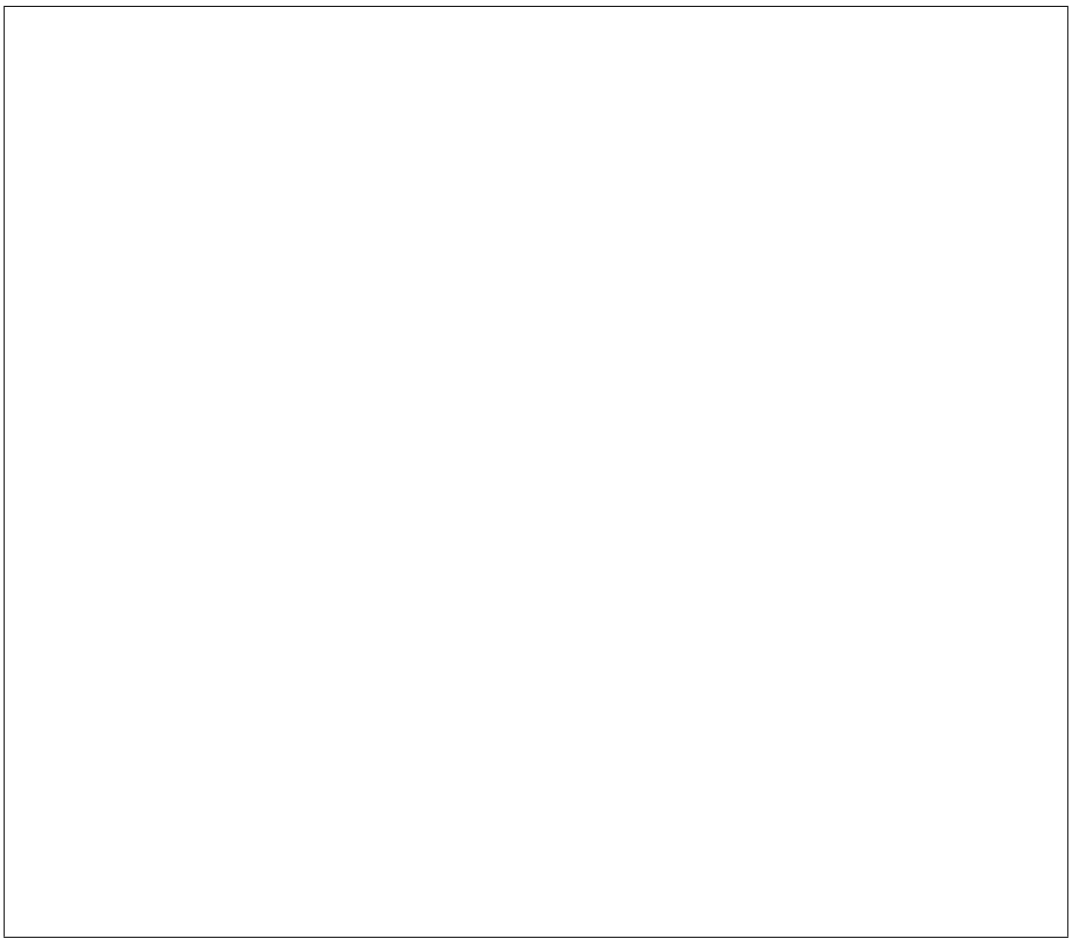
3. Distributivity with addition

$$A(B+C) = AB + BC \tag{4}$$

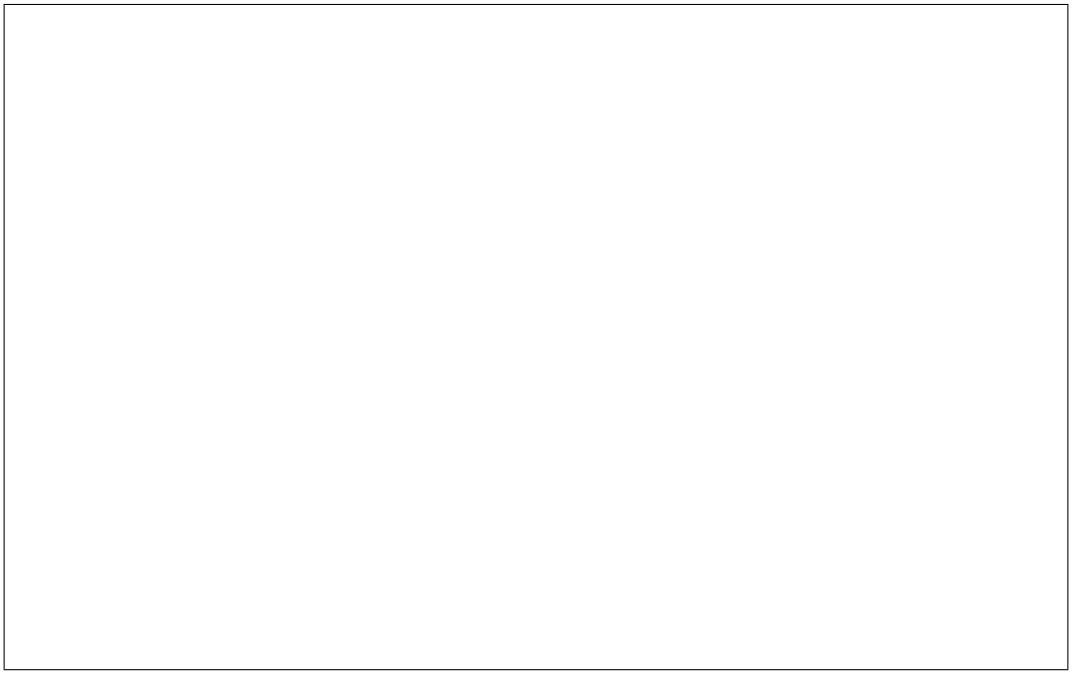
4. Transpose of product

$$(AB)^T = B^T A^T \tag{5}$$

Proof of Associativity



Complexity for both sides. Q: Are they same, different or dependent on different situations?



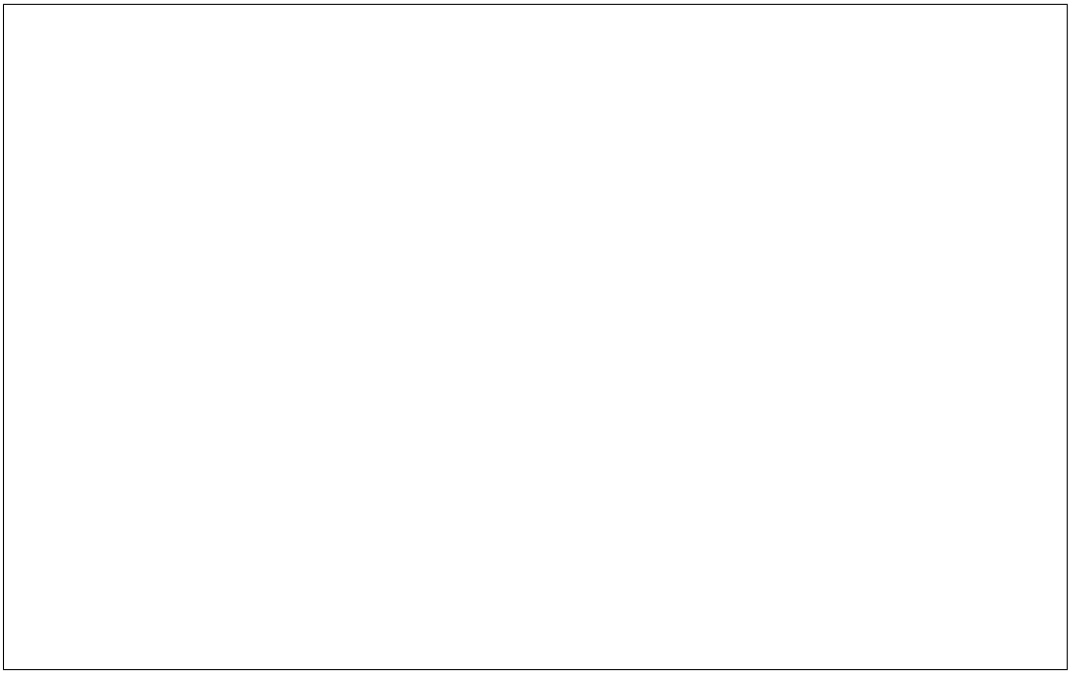
1.2 QR factorization

Input: Matrix A `nxk`, assume ...
Goal: Decompose A into matrix Q and R with special properties.

1. Q Matrix
    - Construction:

$$[q_1, q_2, ..., q_?] \tag{6}$$

    - Properties:
2. R Matrix
    - Construction:



    - Properties:
3. Coding
4. Verify (Take home)