

ECE 257 - LESSON 7 - INTRODUCTION TO MATRIX CALCULATIONS - PART II

SPRING 2007

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IN CLASS

REVIEW OF MATRIX CALCULATIONS

1. Multiplication of square matrices

$$\begin{aligned}A &= [3 \ 1; \ 2 \ 4] \\B &= [2 \ 3; \ 4 \ 3] \\AB &= A*B \\BA &= B*A\end{aligned}$$

2. Multiplication of vectors

$$\begin{aligned}A &= [1 \ 2] \\B &= [3 \ -4]' \\AB &= A*B \\BA &= B*A\end{aligned}$$

3. The identity matrix I

$$\begin{aligned}A &= [2 \ 3; \ 1 \ 4] \\I &= \text{eye}(2) \\AI &= A*I \\IA &= I*A\end{aligned}$$

4. Solving the matrix equation $Ax = b$

$$\begin{aligned}A &= [2 \ 3; \ 1 \ 4] \\b &= [2 \ 3]' \\x1 &= \text{inv}(A)*b \\x2 &= A\b\end{aligned}$$

CUMULATIVE SUMS

6. Sum of the vector $A = [1 \ 2 \ 3]$

$$\begin{aligned}A &= [1 \ 2 \ 3] \\sum_A &= [1 \ 1 \ 1]*A'\end{aligned}$$

7. Cumulative sum of the vector $A = [1 \ 2 \ 3]$

$$\begin{aligned}A &= [1 \ 2 \ 3] \\B &= [1 \ 1 \ 1; \ 0 \ 1 \ 1; \ 0 \ 0 \ 1] \\cumulative_sum &= A*B\end{aligned}$$

a. Describe how this program works

8. Generalizing on our code for calculating the cumulative sum of $A = [1 \ 2 \ 3]$

$$\begin{aligned}A &= [1 \ 2 \ 3] \\B1 &= \text{ones}(3) \\B &= \text{triu}(B1) \\cumulative_sum &= A*B\end{aligned}$$

a. What does the function `triu(B1)` do

9. The cumsum function

```
A = [1 2 3]
cumulative_sum = cumsum (A)
```

- a. What does the function cumsum do

SUMS OF SINUSOIDS

10. Calculation of the following sum: $y(x) = \sum_{k=1}^3 kx$ for $x = 2, 3, 4$

```
k = 1: 3;
x = 2: 4;
k'*x
y = sum(k'*x); % y = [1 1 1]*(k'*x)
table_xy = [x' y']
```

- a. Describe what $k'*x$ is
b. Then explain why $\text{sum}(k'*x)$ gives us y

11. Calculation of the following sum: $y(x) = \sum_{k=1}^3 \cos(kx)$ for $x = 2, 3, 4$

```
k = 1: 3;
x = 2: 4;
y = sum(cos(k'*x)); % y = [1 1 1]*(cos(k'*x))
table_xy = [x' y']
```

12. Calculation of the sum: $y(x) = \sum_{k=1}^3 k \cos(kx)$ for $x = 2, 3, 4$

```
k = 1: 3;
x = 2: 4;
y = k*cos(k'*x);
table_xy = [x' y']
```

13. Plot of the sum $y(x) = \sum_{k=1}^2 k \cos(kx)$ from $x=0$ to $x=4$

```
k = 1: 2;
x = linspace (0, 4*pi, 200);
y = k*cos(k'*x);
plot (x, y)
xlabel ('x')
ylabel ('y')
title ('Sum of two cosines')
```