

ECE 257 - LESSON 2 - INTRODUCTION TO VECTORIZED FUNCTIONS AND CALCULATIONS

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IN CLASS

In the last lesson we showed how to generate vectors and matrices in Matlab. In this Lesson we showed how we can use vectors and matrices in vectorized calculations. This is a key feature of Matlab.

VECTORIZED CALCULATIONS

1. Sum of a matrix and a number

```
>> x1 = 0: 3
>> y1 = x1 + 2
>> x2 = [1 3; 1 4]
>> y2 = x2 - 2
```

- a. What happens when we add a number to a matrix

2. Product of a number and a matrix

```
>> x1 = 2: 3
>> y1 = 2*x1
>> x2 = [1 3; 1 4]
>> y2 = -2*x2
```

- a. What happens when we multiply a matrix by a number

3. More vectorized calculations

```
>> x = 0: 3;
>> y = 2*x + 2
```

- a. Describe what Matlab is doing in these calculations

4. More vectorized calculations

```
>> x = 0: 3;
>> y1 = cos (x)
>> y2 = cos (x + 1)
```

- a. Describe what Matlab is doing in these calculations

5. Putting results in tables

```
>> x = 0: 3;
>> y = x + 2;
>> table_xy = [x' y']
```

- a. How was this table made

SOME VECTORIZED FUNCTIONS

6. Sum function

```
>> a = [2 1 3 2]
```

```
>> a1 = sum (a)
>> b = [2 1 3 2; 3 2 0 1]
>> b1 = sum (b)
>> b2 = sum (sum (b))
```

- What does the *sum* function do to a vector
- What does the *sum* function do to a matrix
- How do we sum all the values in a matrix

7. Sort function

```
>> a = [5 3 7 2]
>> b = sort (a)
>> [b1 b2] = sort (a)
```

- What does the *sort* function give us when there is only one output *b*
- What does the *sort* function give us when there are two outputs [*b1 b2*]

8. Max and min functions

```
>> a = [5 3 7 9]
>> b = max (a)
>> [b1 b2] = max (a)
>> c = min (a)
>> [c1 c2] = min (a)
```

- What do the *max* and *min* functions give us when there is only one output
- What do the *max* and *min* functions give us when there are two outputs

M-FILES

- Type the following Matlab script in the editor and then save it as an M-file by saving it as *table.m*. Then run it in the command window by typing *table*. Note that the name of an M-file must be different from the names of the variables in it

```
%script for generating a table
x = 1:3;
y = x + 2;
table_xy = [x' y']
```

- What is the advantage of M-files

10. Breakpoints - Press F5 to go from one breakpoint to the next

```
% script for generating a table
x = 1:3
• y = x + 2
• table_xy = [x' y']
```

- What are breakpoints
- What are breakpoints good for

SOME VECTORIZED SUMS

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

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

a. Describe how this program works

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

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

a. Describe how this program works