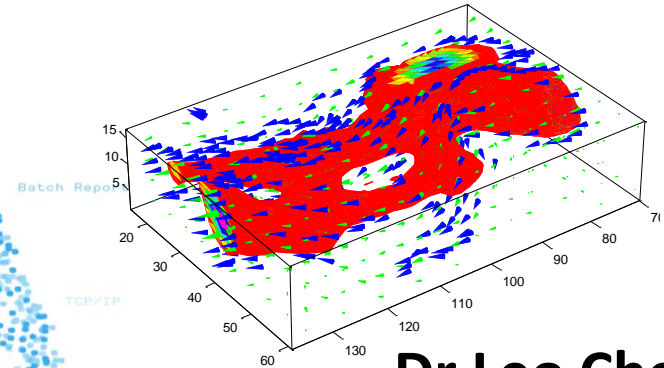
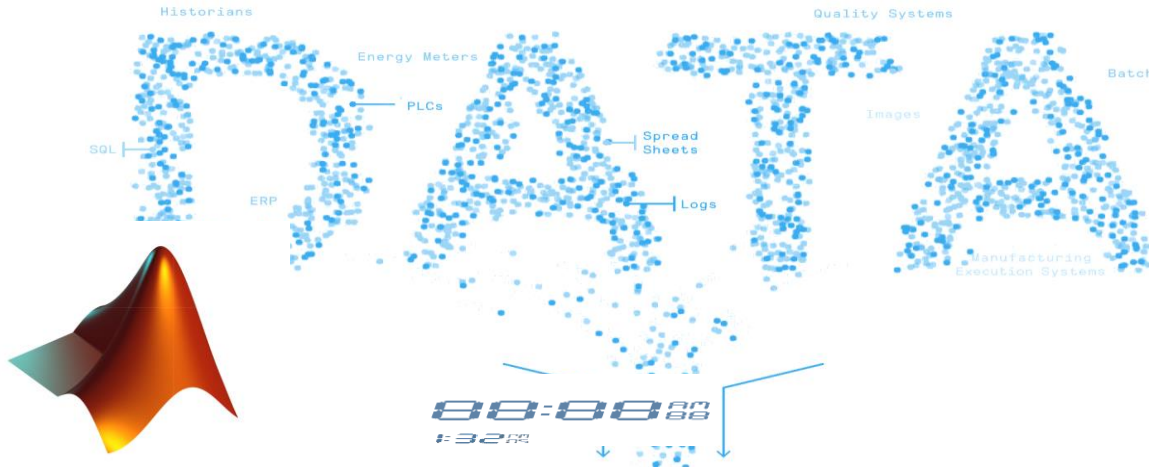




MATLAB Fundamental Laboratory Handbook (MATLAB)

Chapter 3 Vectors, Arrays, Matrices, and Data Structures



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3. 1 Lab

Objective: Practice the use of **vector**.

Content: $f(x) = 3x^5 - 5x^4 - x^3 + 9x + 6$, $g(x) = 7x^4 + 5x - 3$, computer $f(x) + g(x)$, $f(x) - g(x)$, $f(x) \times g(x)$, $f(x) \div g(x)$.

```
f = [3 -5 -1 0 9 6];  
g = [7 0 0 5 -3];  
  
result1 = f + [0 g]           %  
addition  
result2 = f - [0 g]           %  
subtract  
result3 = conv(f,g)           %  
multiply  
[result4 r] = deconv(f,g)     % divide
```

Results:

```
result1 = 1×6  
    3     2    -1     0    14     3  
result2 = 1×6  
    3   -12    -1     0     4     9  
result3 = 1×10  
    21   -35    -7    15    29    52     3    45     3   -18  
result4 = 1×2  
    0.4286   -0.7143  
r = 1×6  
     0     0   -1.0000   -2.1429   13.8571    3.8571
```

3. 2 Lab

Objective: Practice the use of **array**.

Content: Find all elements in the array $A = \begin{bmatrix} -7 & -1 & 5 \\ -5 & 1 & 7 \\ -3 & 3 & 9 \end{bmatrix}$ whose absolute value is greater than 5.

```
A = zeros(3,3);  
A(:) = -7:2:9; % Use the "full element" assignment method to  
obtain A  
L = abs(A)>5; % Generates a logical array with the same  
dimension as A  
B = A(L); % Take the element in A corresponding to the logical  
value 1 in L  
B = B';  
disp(A);  
disp(B);
```

Results:

-7	-1	5
-5	1	7
-3	3	9
-7	7	9

3. 3 Lab

Objective: Practice the use of **matrix**.

Content: Solve equation group

$$\begin{cases} 4.6x_1 - 2.31x_2 + 8.3x_3 + 29.4x_4 = 40.34 \\ 20.5x_1 + 8.7x_2 + 40.1x_3 - 11.9x_4 = 1.15 \\ 36.4x_1 + 0.92x_2 - 3.7x_3 + 64.3x_4 = 32.4 \\ 7.84x_1 + 40.01x_2 - 2.68x_3 - 7.92x_4 = 27.55 \end{cases}$$

```
A = [4.6 -2.31 8.3 29.4; 20.5 8.7 40.1 -11.9; 36.4 0.92 -3.7  
64.3; 7.84 40.01 -2.68 -7.92];  
b = [40.34;1.15;32.4;27.55];  
x = A\b;  
disp(x')
```

Results:

-1.6082 1.3572 0.9872 1.4517

3. 4 Lab

Objective: Practice the use of **cell arrays**.

Content: Store the data listed in Table 3-1 in a cell array **S** with eight rows and 3 columns. The first column of **S** is their name, column 2 is their scores of three subjects, column 3 is the total score. Add a column in the **S** to indicate the student's grade: grade 'A' for the total score of more than 240; The total score is between 180 and 240, with a grade of 'B'; And the total score of less than 200 is graded 'C'.

Table 3-1 Grade sheet for 8 students

name	chinese	math	english
zhao	88	95	91
qian	92	94	99
sun	74	64	81
li	98	77	83
zhou	61	41	80
wu	52	25	33
zheng	82	73	79
wang	79	95	77

```
names = ["zhao", "qian", "sun", "li",  
         "zhou", "wu", "zheng", "wang"];  
scores = [88, 92, 74, 98, 61, 52, 82, 79;  
          95, 94, 64, 77, 41, 25, 73, 95;  
          91, 99, 81, 83, 80, 33, 79, 77];  
S = cell(8,3);  
for i = 1:8  
    name = names(i);  
    score = scores(:,i);  
    total_score = sum(score);  
    S(i,:) = {name, score,  
             total_score};
```

```
for j = 1:size(S,1)  
    total_score = S{j,3};  
    % Judge grades  
    if total_score > 240  
        grade = {'A'};  
    elseif total_score >= 180  
        grade = {'B'};  
    else  
        grade = {'C'};  
    end  
    S(j,4) = grade;  
End
```

3. 5 Lab

Objective: Practice the use of **structure**.

Content: Create a structure that contains information about the 8 students in Table 3-1 and calculate the total and average scores of these students.

```
students = struct('name', {'zhao', 'qian', 'sun', 'li', 'zhou', 'wu', 'zheng', 'wang'},...  
'chinese', {88, 92, 74, 98, 61, 52, 82, 79},...  
'math', {95, 94, 64, 77, 41, 25, 73, 95},...  
'english', {91, 99, 81, 83, 80, 33, 79, 77});  
scores = [students.chinese; students.math; students.english];  
names = {students.name};  
x = sum(scores);  
disp('The total score of each student is:');  
disp(x);  
disp('The average score of each student is:');  
disp(x/3);
```

Results:

The total score of each student is:

274 285 219 258 182 110 234 251

The average score of each student is:

91.3333 95.0000 73.0000 86.0000 60.6667 36.6667 78.0000 83.6667

3. 6 Lab

Objective: Practice the use of **string**.

Content: A fruit store has two warehouses in which different kinds of fruit are stored. Use set arithmetic (集合运算) to determine which fruits are common to two warehouses and which fruits are unique to each warehouse, and find all fruits in both warehouses.

```
warehouse1 = ["apple" "banana" "strawberry"  
"pear" "watermelon"];  
warehouse2 = ["banana" "orange" "pear"  
"pineapple" "litchi"];  
x1 = intersect(warehouse1, warehouse2);  
x2 = setdiff(warehouse1, warehouse2);  
x3 = setdiff(warehouse2, warehouse1);  
x4 = union(warehouse1, warehouse2);  
disp(x1); disp(x2); disp(x3); disp(x4)
```

Results:

```
"banana" "pear"  
  
"apple" "strawberry" "watermelon"  
  
"litchi" "orange" "pineapple"  
  
"apple" "banana" "litchi" "orange" "pear"  
"pineapple" "strawberry" "watermelon"
```

3. 7 Lab

Objective: Practice the use of **tables**.

Content: Read the stock data from the Excel table, store it in a table, calculate the average value of the highest and lowest price, add it as a column to the table. Calculate the absolute value of the close price and the open price, add it as a column to the table, and then display the data of the third day.

```
data = readtable('data.xlsx');  
data(:, 'average')=(data.high+data.low)/2; % add average value  
data(:, 'difference')=abs(data.close-data.open); % add absolute difference  
value  
disp(data(3,:)); % display the data of the third day
```

Results:

date	open	high	low	close	average	difference
2024-03-03	35.18	35.31	34.5	35.16	34.905	0.02

3. 8 Lab

Objective: Practice the use of **sort** and **index**.

Content: For Lab3.5, after the total score of these students is obtained, sort the students according to the total score, and then print the names of these students in turn.

```
..... % (this part is same with  
Lab3.5)  
x = sum(scores);  
disp('The total score of each  
student is:');  
disp(x);  
[B, sy] = sort(x, 'descend');  
disp('The ranking is:')  
for i = 1:8  
e = B(i);  
d = find(x==e);  
disp(names(d))  
end
```

Results:

The total score of each student is:

274 285 219 258 182 110 234 251

The ranking is:

{ 'qian' }

{ 'zhao' }

{ 'li' }

{ 'wang' }

{ 'zheng' }

{ 'sun' }

{ 'zhou' }

{ 'wu' }