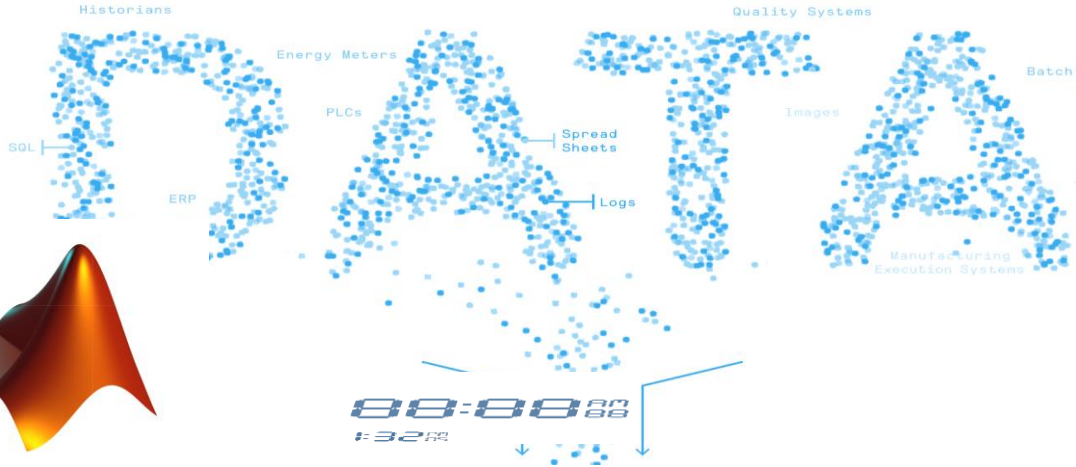
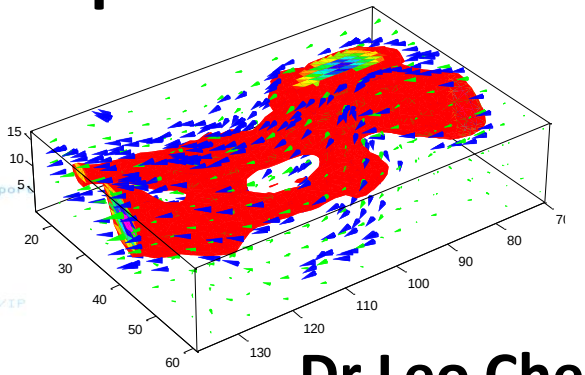
MATLAB Fundamental Laboratory Handbook (MATLAB)

Chapter 2 Types, Operators and Expressions





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2.1 Lab

Objective: Practice Creating Variables and Type Conversion.

Content:

1. Create a variable date1, equal to the date of today.
2. Create a variable num, equal to 100.
3. Create a variable date2, equal to date1+num.
4. View the size and type of the above variables.

```
date1 = datetime('today');
num = 100;
date2 = date1 + num;
% View the size and type of the above
variables
whos date1 date2 date3 num str is_same
diff
```

Results:

Name	Size	Bytes	Class	Attributes
date1	1x1	8	datetime	
date2	1x1	8	datetime	
num	1x1	8	double	

2.2 Lab

Objective: Create a function.

Content: Create a function that adds two numbers.

```
function y = calculateSum(x1, x2)
    y = x1 + x2;
end
```

```
y = calculateSum(7, 9.6)
```

Results:

```
y = 16.6000
```

2.3 Lab

Objective: Know the range of various data types.

Content: Use intmin, intmax, realmax, and realmin to return ranges of various data types.

```
% Integer
[intmin("int8") intmax("int8")]
[intmain("int16") intmax("int16")]
[intmain("int32") intmax("int32")]
[intmain("int64") intmax("int64")]
[intmin("uint8") intmax("uint8")]
[intmain("uint16") intmax("uint16")]
[intmain("uint32") intmax("uint32")]
[intmain("uint64") intmax("uint64")]

%Floating number
[-realmax('single') -realmin('single') realmin('single')
realmax('single')]
[-realmax -realmin realmin realmax]
```

These ranges are displayed using the fprintf command:

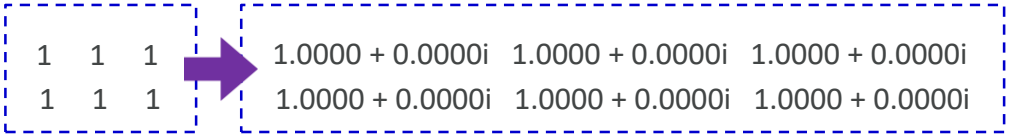
```
The range of int8 is -128 to 127.
The range of int8 is -32768 to 32767.
The range of int8 is -2147483648 to 2147483647.
The range of int8 is -9223372036854775808 to
9223372036854775807.
The range of int8 is 0 to 255.
The range of int8 is 0 to 65535.
The range of int8 is 0 to 4294967295.
The range of int8 is 0 to 1.844674e+19.
The range of int8 is -3.402823e+38 to -1.175494e-38 and
1.175494e-38 to 3.402823e+38.
The range of int8 is -1.797693e+308 to -2.225074e-308 and
2.225074e-308 to 1.797693e+308.
```

2.4 Lab

Objective: Cast various data types.

Content: Cast an all-1 array to a complex array.

```
A = ones(2,3);
p = complex(1,1);
B = cast(A, 'like', p);
```



Content: Cast a hexadecimal floating-point number to a decimal floating-point number.

```
a = 'b6eae18b';
c = typecast(uint32(hex2dec(a)),'single');
```

The value of c：

```
-7.0000e-06
```

2.5 Lab

Objective: Know the Machine Epsilon of the floating point number.

Content: Determine whether the results of the three equations (same numbers, different order) are equal.

```
x1 = 0.33 - 0.5 + 0.17;
x2 = 0.33 + 0.17 - 0.5;
x3 = 0.17 - 0.5 + 0.33;

%Show results
fprintf('The value of x1 is %d.\n',x1);
fprintf('The value of x2 is %d.\n',x2);
fprintf('The value of x3 is %d.\n',x3);
```

Results:

```
The value of x1 is 2.775558e-17.
The value of x2 is 0.
The value of x3 is 5.551115e-17.
```

```
%Use "==" to determine
disp(x1 == x2);
disp(x1 == x3);
disp(x2 == x3);

% Determine with the precision
disp(abs(x1-x2)<eps);
disp(abs(x1-x3)<eps);
disp(abs(x2-x3)<eps);
```

Results:

```
0
0
0
1
1
1
```

x1, x2, x3 should be the same, but because these data are stored in binary, there are often some unavoidable errors when using double precision numbers to express, but these errors are smaller than eps.

2.6 Lab

Objective: Practice the use of Arithmetic Operator.

Content: Calculate the value of the following mathematical expressions

(1) $\sin\left(\frac{|15-91+7|^2}{8}\right)$

(2) $5.8^{2.4\times1.9}$

(3) $\tan(\sqrt{2})+\ln\left(\cos\left(\frac{\pi}{2}\right)\right)$

(4) $e^{(1+\sin(10))}$

```
sin(abs(15-91+7)^2/8)
5.8^(2.4*1.9)
tan(sqrt(2))+log(cos(pi/2))
exp(1+sin(10))
```

Results:

```
ans = -0.9787
ans = 3.0285e+03
ans = -30.9977
ans = 1.5777
```

2.7 Lab

Objective: Practice the use of Relational Operator.

Content: Find the location of numbers greater than 60 in the vector A = [203 15 9 64 52 47 87 9 11], then extract those numbers.

```
A = [203 15 9 64 52 47 87 9 11];
I = find(A > 60)
A(I)
```

Use the relational operator ">".

Results:

```
I = 1×3
     1     4     7

ans = 1×3
   203    64    87
```

The running result shows that the values greater than 60 in the vector are 203, 64, 87, and their positions are 1, 4, and 7 respectively.

2.8 Lab

Objective: Practice the use of Logical Operator.

Content: Find and extract all even numbers in the vector [67 83 46 92 8 332 26 583].

```
A = [67 83 46 92 8 332 26 583];
B = mod(A,2);
C = ~B;
A(C)
```

Use the logical operator "~".

Results:

```
ans = 1×5
    46    92     8   332    26
```

The results show that the even numbers in the vector are 46, 92, 8, 332, and 26.

2.9 Lab

Objective: Practice the use of Assignment Operator.

Content: Practice using "=" assignment and deal function assignment.

```
%Direct assignment
x1 = 88;
fprintf('The value of x1 is %d.\n',x1);

%Assign values using the deal function
[y1, y2, y3] = deal(11);
fprintf('The value of y1 is %d.\n',y1);
fprintf('The value of y2 is %d.\n',y2);
fprintf('The value of y3 is %d.\n',y3);
[z1, z2, z3] = deal(21, 22, 33);
fprintf('The value of z1 is %d.\n',z1);
fprintf('The value of z2 is %d.\n',z2);
fprintf('The value of z3 is %d.\n',z3);
```

Results:

```
The value of x1 is 88.
The value of y1 is 11.
The value of y2 is 11.
The value of y3 is 11.
The value of z1 is 21.
The value of z2 is 22.
The value of z3 is 33.
```

The equal sign can assign a value to a single variable, and the deal function can assign multiple variables at the same time.

2.10 Lab

Objective: Practice the use of Assignment Operator.

Content:

1. Load the file height.mat.
2. Create age by converting ageMos from months to years.
3. Create avgM and avgF by converting avgMcm and avgFcm from centimeters to feet (1 ft = 30.48 cm).
4. Plot both converted heights versus age.
5. Add a title, axis labels, and a legend.
6. Calculate and plot the height difference between genders in inches.
7. Add a black dashed line where the difference is zero.

```
edit heightByAge_template.mlx
edit heightByAge.mlx
```