

MATLAB - Lecture # 8

Programming in MATLAB / Chapter 7

Topics Covered:

1. Relational and Logical Operators
2. Conditional statements.

if-end

if-else-end

if-elseif-else-end

INTRODUCTION TO PROGRAMMING

- In a simple program the commands are executed in the order they are typed.
- Many situations may require that:
 - * Commands will not be executed in order.
 - * Different commands are executed in different runs.
 - * The execution of a group of commands is repeated many times.

INTRODUCTION TO PROGRAMMING

- MATLAB provide tools (commands) that can be used to control the flow of a program.
- Read Chapter 7 in the MATLAB book.
- In the class we will only cover **if-end** conditional statements (this lecture) and **for-end** loops (next lecture).
- Students can learn other tools from the book by themselves.

RELATIONAL OPERATORS

Relational operator

Meaning

<

Less than.

<=

Less than or equal to.

>

Greater than.

>=

Greater than or equal to.

==

Equal to.

~=

Not equal to.

- Relational operators compare two numbers in a comparison statement.
- If the statement is true, it is assigned a value of 1.
- If the statement is false, it is assigned a value of 0.

RELATIONAL OPERATORS, EXAMPLES

```
>> 5>8
```

```
ans =
```

```
0
```

Since 5 is not larger than 8 the answer is 0.

```
>> a=5<10
```

```
a =
```

```
1
```

Checks if 5 is smaller than 10, and assigns the answer to **a**.

Since 5 is smaller than 10 the number 1 is assigned to **a**.

```
>> y=(6<10) + (7>8) + (5*3==60/4)
```

```
y =
```

```
2
```

=1

=0

=1

LOGICAL OPERATORS

- Logical operators have numbers as operands.
- A nonzero number is true.
- A zero number is false.

<u>Logical Operator</u>	<u>Name</u>	<u>Meaning</u>
& Example: $A \& B$	AND	True if both operands (A and B) are true.
 Example: $A B$	OR	True if either or both operands (A and B) are true.
~ Example: $\sim A$	NOT	True if the operand (A) is false. False if the operand (A) is true.

LOGICAL OPERATORS, EXAMPLES

```
>> 3&7
```

3 AND 7.

```
ans =
```

```
1
```

3 and 7 are both true (nonzero), so the outcome is 1.

```
>> a=5|0
```

5 OR 0 (assign to variable **a**).

```
a =
```

```
1
```

1 is assigned to **a** since at least one number is true (nonzero).

```
>> x=-2; y=5;
```

Define variables **x** and **y**.

```
>> -5<x<-1
```

```
ans =
```

```
0
```

Mathematically correct. The answer is false since MATLAB executes from left to right. $-5 < x$ is true (=1) and then $1 < -1$ is false (0).

```
>> -5<x & x<-1
```

```
ans =
```

```
1
```

The mathematically correct statement is obtained by using the logical operator **&**. The inequalities are executed first. Since both are true (1), the answer is 1.

CONDITIONAL STATEMENTS

- Conditional statements enable MATLAB to make decisions.
- The process is similar to the way we (humans) make decisions.
- A condition stated. If the condition is met, one set of actions is taken. If the condition is not met, either nothing is done, or a second set of actions is taken.

Example:

If I win the Lottery,

I will quit college, buy a new car, and go fishing.

If I do not win the Lottery,

I will study harder so that I can get a better job.

THE FORM OF A CONDITIONAL STATEMENT

If Conditional expression

consisting of relational
and/or logical operators

Examples:

```
if a < b
```

```
if c >= 5
```

```
if a == b
```

```
if a ~= 0
```

```
if (d<h)&(x>7)
```

```
if (x~=13) | (y<0)
```

All variables must
have assigned values.

THREE FORMS OF THE `if` STATEMENT

`if` conditional statement

commands

`end`

`if` conditional statement

command group 1

`else`

command group 2

`end`

`if` conditional statement 1

command group 1

`elseif` conditional statement 2

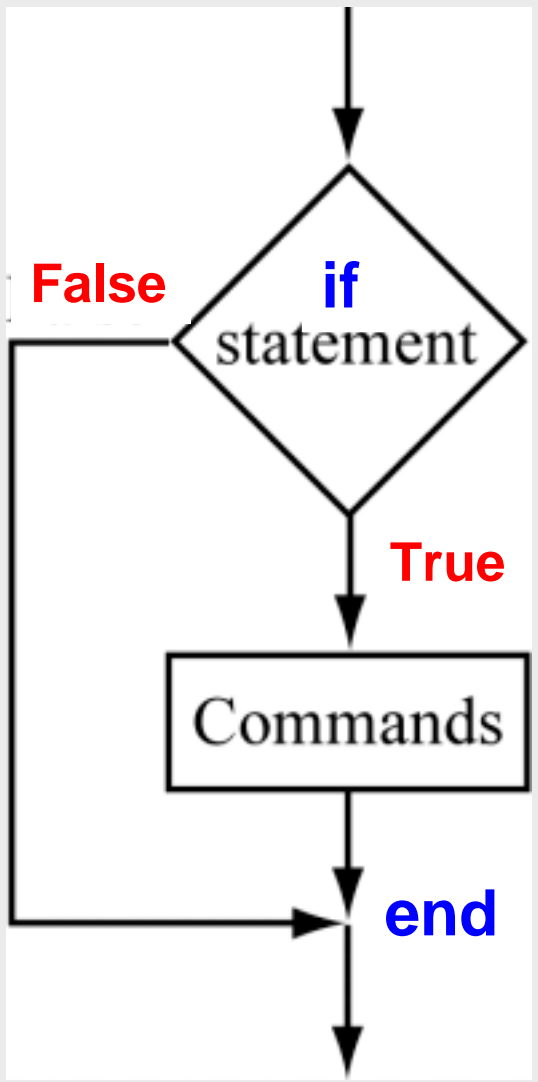
command group 2

`else`

command group 3

`end`

THE **if-end** STATEMENT



.....
 MATLAB program.

if conditional expression

.....
 A group of MATLAB commands.

end

.....
 MATLAB program.

EXAMPLE OF USING THE `if-end` STATEMENT

```
% A script file that demonstrates the use of the if-end statement.  
% The user is asked to enter three grades.  
% The program calculates the average of the grades.  
% If the average is less than 60, a message:  
% The student did not pass the course. is printed.
```

```
score = input('Enter (as a vector) the scores of the three tests ');  
ave_grade = (score(1) + score(2) + score(3))/3;  
disp('The average grade is:')  
disp(ave_grade)  
if ave_grade < 60  
    disp('The student did not pass the course.')end
```

EXAMPLE OF USING THE `if-end` STATEMENT

Executing the script file of the previous slide in the Command Window:

```
>> Lecture8Example1
```

```
Enter (as a vector) the scores of the three tests [78 61 85]
```

```
The average grade is:
```

```
74.6667
```

```
>> Lecture8Example1
```

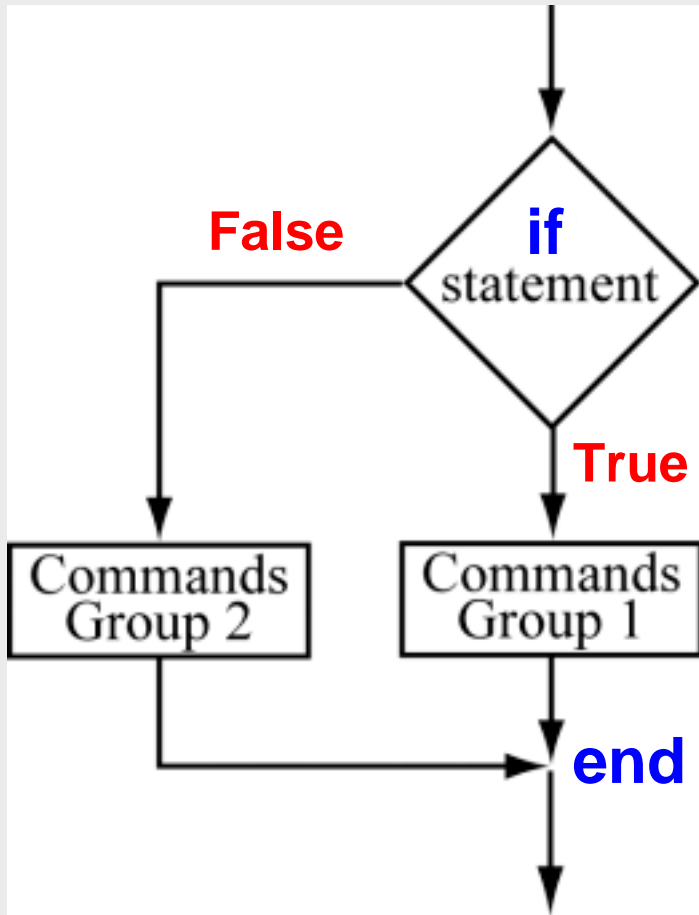
```
Enter (as a vector) the scores of the three tests [60 38 55]
```

```
The average grade is:
```

```
51
```

```
The student did not pass the course.
```

THE `if-else-end` STATEMENT



.....
.....

MATLAB program.

`if` conditional expression

.....
.....
.....

Group 1 of MATLAB commands.

`else`

.....
.....
.....

Group 2 of MATLAB commands.

`end`

.....
.....

MATLAB program.

EXAMPLE OF USING THE if-else-end STATEMENT

```
% A script file that demonstrates the use of the if-else-end statement.
% The user is asked to enter three grades. The program calculates
% the average of the grades. If the average is less than 60, a
% message: The student did not pass the course. is printed.
% Otherwise, a message: The student passed the course. is printed.

score = input('Enter (as a vector) the scores of the three tests ');
ave_grade = (score(1) + score(2) + score(3))/3;
disp('The average grade is:')
disp(ave_grade)
if ave_grade < 60
    disp('The student did not pass the course.')
else
    disp('The student passed the course.')
end
```

EXAMPLE OF USING THE if-else-end STATEMENT

Executing the script file of the previous slide in the Command Window:

```
>> Lecture8Example2
```

```
Enter (as a vector) the scores of the three tests [65 80 83]
```

```
The average grade is:
```

```
76
```

```
The student passed the course.
```

```
>> Lecture8Example2
```

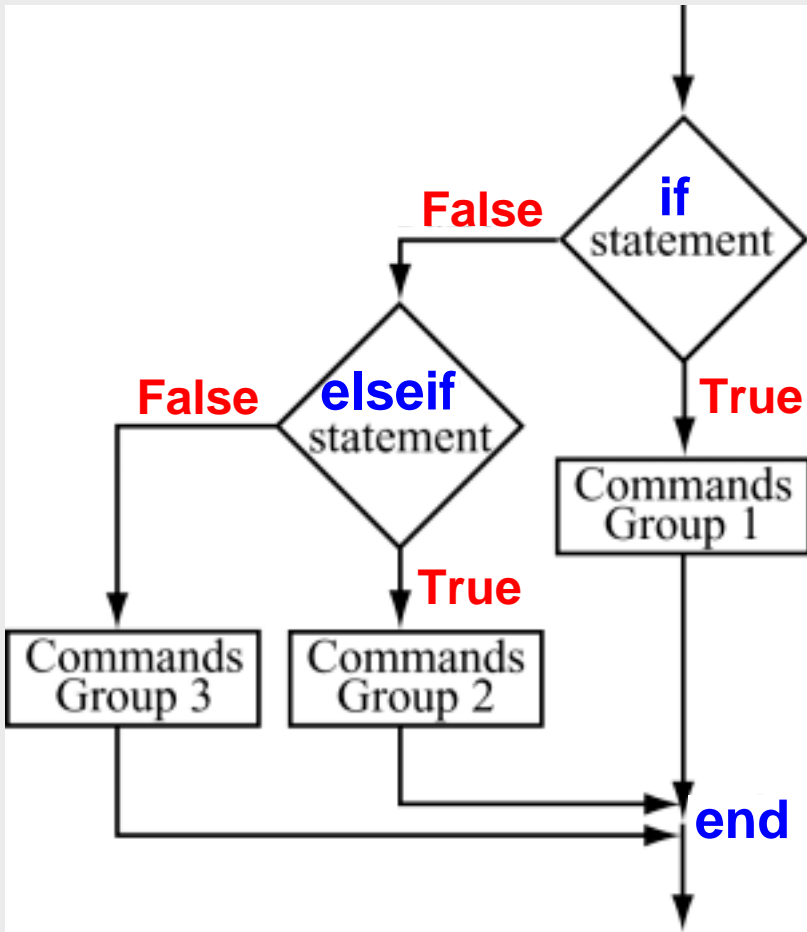
```
Enter (as a vector) the scores of the three tests [60 40 55]
```

```
The average grade is:
```

```
51.6667
```

```
The student did not pass the course.
```


THE `if-elseif-else-end` STATEMENT



.....

 MATLAB program.

`if` conditional expression

 Group 1 of MATLAB commands.

`elseif` conditional expression

 Group 2 of MATLAB commands.

`else`

 Group 2 of MATLAB commands.

`end`

 MATLAB program.

EXAMPLE OF USING THE if-elseif-else-end STATEMENT

```
% A script file that demonstrates the use of the if-elseif-else-end
% statement.
% The program calculates the tip in a restaurant according to the
% amount of the bill.
% If the bill is less than 10$ the tip is $1.80.
% Between $10 and $60 the tip is 18% of the bill.
% Above $60 the tip is 20% of the bill.

format bank
clear tip
```

(The file continues on the next slide)

(Continuation from the previous slide)

```
bill = input('Enter the amount of the bill (in dollars): ');  
if bill <= 10)  
    tip = 1.8;  
elseif (bill > 10) & (bill <= 60)  
    tip = bill*0.18;  
else  
    tip = bill*0.2;  
end  
disp('The tip is (in dollars):')  
disp(tip)
```

EXECUTING THE SCRIPT FILE OF THE RESTAURAT TIP CALCULATION

```
>> Lecture8Example3
```

```
Enter the amount of the bill (in dollars): 15
```

```
The tip is (in dollars):
```

```
2.70
```

```
>> Lecture8Example3
```

```
Enter the amount of the bill (in dollars): 6
```

```
The tip is (in dollars):
```

```
1.80
```

```
>> Lecture8Example3
```

```
Enter the amount of the bill (in dollars): 100
```

```
The tip is (in dollars):
```

```
20.00
```

COMMENTS ABOUT **if-end** STATEMENTS

- For every **if** command a computer program must have an **end** command.
- A program can have many **if** **end** statements following each other.
- A computer program can perform the same task using different combinations of **if - end**, **if - else - end**, and **if - elseif - else - end** statements.

MATLAB ASSIGNMENT 8:

1. MATLAB book, Chapter 7, Problem 1.
2. MATLAB book, Chapter 7, Problem 8.
3. MATLAB book, Chapter 7, Problem 16.

In problem 1 submit a printout of the Command Window.

In problems 2 and 3 submit a printout of the script file, and a printout of the Command Window showing how the script file was used.

The first line in the script file, and in the Command Window should be a comment with your name.