Lecture 3
Advanced Selection and Formatted Output

Nested if-else, if-elseif, operators precedence, fprintf

Overview

- if-else statement
- Nested if-else statements
- If-elseif statement
- Operators Precedence
- fprintf function
- fprintf a table
- Plotting 2D graph
- Saving to a file

If-else statement

```
if condition
        % do this part if condition is true
else
        %do this part if the condition is false
end
```

Condition (use relational operators):

>, <, >=, <=, ==, ~=

Logical operators:

&&, ||, ~

Print how two numbers are sorted (Asc or Desc)

```
X=input('enter num1:');
Y=input('enter num2:');

if X>Y
        disp('Desc');
else
        disp('Asc');
end
```

What about three cases:

Asc

Desc

Equal

I will need to add one more if statement

Print how two numbers are sorted (Asc or Desc or Equal)

```
X=input('enter num1:');
Y=input('enter num2:');
if X>Y
        disp('Desc');
else
        if X<Y
                disp('Asc');
        else
                disp('Equal');
        end
end
```

?

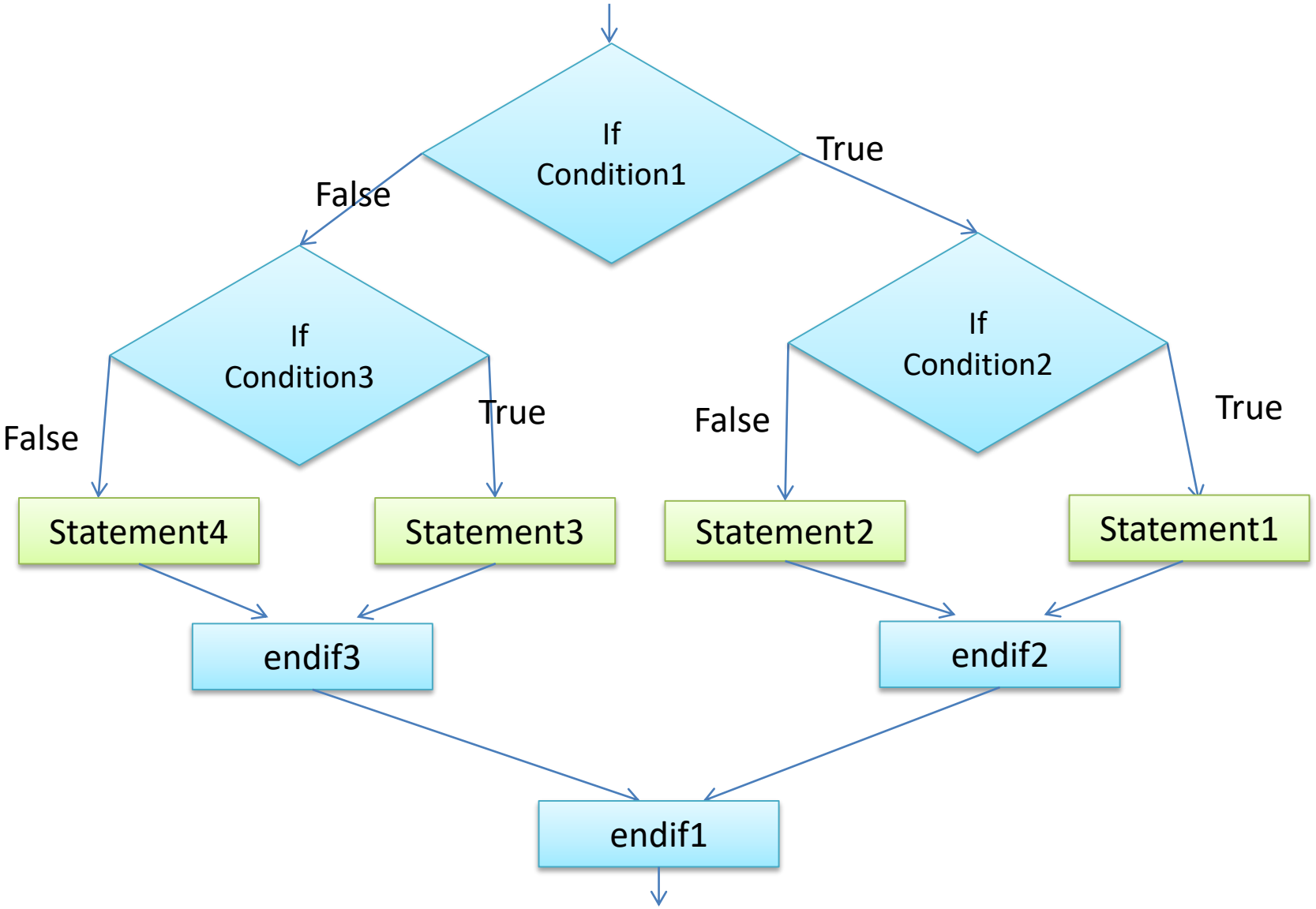
Try

- 1, 2
- 3, 2
- 2, 2

Nested If-else statement

```
if condition1
        % do this part if condition1 is true
        if codition2
                %do this part if both conditions true
        else
                %do this part if cond1 is true but cond2 false
        end
else
        %do this part if the condition1 is false
        if codition3
                %do this part if cond1 is false but cond2 true
        else
                %do this part if both condition false
        end
end
```

Branching Example



Print how three numbers are sorted (Algorithm)

Given X, Y, Z print if they are sorted Ascending, descending or not sorted. [1, 2, 3 are sorted Asc 3, 2, 1 Desc 2,1,3 not sorted]

1. Get number1 as X
2. Get number2 as Y
3. Get number3 as Z
4. If X > Y > Z
   disp('Desc');
   Otherwise
   if X<Y<Z
   display 'Asc'
   Otherwise
   display 'Not Sorted'

Print how three numbers are sorted (Algorithm → Program)

1. Get number1 as X → X=input('enter num1:');
2. Get number2 as Y → Y=input('enter num2:');
3. Get number3 as Z → Z=input('enter num3:');

4. If X > Y > Z
   display 'Desc'
   Otherwise
   if X<Y<Z
   display 'Asc'
   Otherwise
   display 'Not Sorted'

→

```
if X>Y && Y > Z
        disp('Desc');
else
        if  X<Y && Y < Z
                disp('Asc');
         else
                disp('not sorted');
        end
end
```

Print how three numbers are sorted (Program & Testing)

```
X=input('enter num1:');
Y=input('enter num2:');
Z=input('enter num3:');
if X>Y && Y > Z
        disp('Desc');
else
        if  X<Y && Y < Z
                disp('Asc');
         else
                disp('not sorted');
        end
end
```

?

Try

- 1, 2, 3
- 3, 2, 1
- 2, 1, 3

Special Nested if statement

```
if condition1
        % do this part if condition1 is true
else
        %do this part if the cond1 is false
        if codition2
                %do this part if cond2 is true
        else
                %do this part if cond2 is false
                 if codition3
                        %do this part if cond3 is true
                else
                        %do this part if cond3 is false
                end
        end
end
```

if-elseif statement

```
if condition1
        % do this part if cond1 is true
elseif codition2
        %do this part if cond2 is true
elseif codition3
        %do this part if cond3 is true
else
        %do this part if all cond are false
end
```

Print how three numbers are sorted (Using if-elseif)

```
X=input('enter num1:');
Y=input('enter num2:');
Z=input('enter num3:');
if X>Y && Y > Z
        disp('Desc');
else
        if  X<Y && Y < Z
              disp('Asc');
         else
               disp('not sorted');
        end
end
```

```
X=input('enter num1:');
Y=input('enter num2:');
Z=input('enter num3:');
if X>Y && Y > Z
        disp('Desc');
elseif  X<Y && Y < Z
        disp('Asc');
else
        disp('not sorted');
end
```

Print how three numbers are sorted (Extended Cases)

```
X=input('enter num1:');
Y=input('enter num2:');
Z=input('enter num3:');
if (X>=Y && Y > Z) || (X>Y && Y >= Z)
        disp('Desc');
elseif  (X<Y && Y <= Z) || (X<=Y && Y < Z)
        disp('Asc');
else
        disp('not sorted');

end
```

?

What about:

- 2, 2, 1
- 2, 1, 1
- 1, 2, 2
- 1, 1, 2

What this program does?

```
disp('1. square');
disp('2. circle');
s=input('Select a shape (1-2):');
if s==1
        disp('Calculating area of a square');
        l=input('enter length:');
        a=l^2;
        disp(a);
elseif s==2
        disp('Calculating area of a circle');
        r=input('enter radius:');
        a=pi*r^2;
        disp(a);
else
        disp('Select only from the range (1-2)');
end
```

?

- Add more shapes
- Make the program to repeat itself N times

Operators Precedence

1. ( ) parentheses (inner to outermost)
2. ^, -, ~ (exponentiation, negation, not) Unary operators
3. *,/ multiplication and division
4. +, - addition and subtraction
5. <, >, <=, >=, ==, ~=
6. && And
7. || Or

Operators Precedence (Summary)

1. Parenthesis are evaluated inner to outermost
2. Unary Operators are evaluated (^, -, then ~)
3. Arithmetic operations are evaluated left to right (*, /, +, -)
4. Relational operators are evaluated from left to right (<, >, <=, >=, ==, ~=)
5. Logical AND then Logical OR are evaluated from left to right (&& then ||)

Arithmetic Operations Examples

Write the MATLAB expression to evaluate the following equations

$$a = \frac{x^2 + y^2}{3z};$$

```
a=x^2 + y^2/3*z;
a=(x^2 + y^2)/3*z;
a=(x^2 + y^2)/(3*z);
```

$$a = \frac{3x + 4yz + 5}{x + y};$$

```
a=3x + 4yz+5/x+y;
a=3*x + 4*y*z+5/x+y;
a=(3*x + 4*y*z+5)/(x+y);
```

$$a = \frac{(2x + 3y)^2}{3z + 5};$$

Evaluating Arithmetic Operations Examples

What the results would be for the following expressions (do it by hand then test it on MATLAB):

1. a = 5 + 5 / 10 → = 5+0.5 = 5.5
2. a = (5 + 5) / 10 → = 10/10 = 1
3. a = 5 + 5 / 10 * 2 → = 5+0.5*2 = 5+1 = 6
4. a = 5 + 5 / (10 * 2) → =5+5/20 = 5+0.25=5.25
5. a = ((5+5)/((3+2)*2)) → = ((5+5)/(5*2)) = (10/10)=1

Arithmetic/Logical Operations Examples

Write the operations' order of the following expressions:

1. Z= x+y*3/x^2; → ^, *, /, +, =
2. Z=(x+y)*3/x^2; → +, ^, *, /, =
3. Z=x+y*(3/x)^2; → /, ^, *, +, =
4. x-2>y+3 && x*2<y^3 || x*y>1
5. (x-2>y+3 && x*2<y^3) || (x*y<1 || x<y)

`fprintf` function

- `fprintf` can be used to control how output is displayed

  `fprintf(format,data1,data2, …)`

- `format` is a string specifying how to display the data
- `data`*`x`* are variables or values
- Example:

```
fprintf('x=%f and y=%f',x,y)
```

`fprintf` function

- The `%d` characters in the format string are called “conversion characters”
- Each conversion character is a data place-holder in the format string
- Each conversion character has a number of optional formatting parameters
- These parameters go between the `%` and the conversion character (`d`, `f`, etc.)

`fprintf` conversion characters

%?	Results
`%d`	display value in standard decimal notation
`%e`	display value in exponential form
`%f`	display value in fixed(floating)-point form
`%s`	display a string of characters (not used with numbers)

- For complete list of options, use

>> help fprintf

Examples:

%d like 15

%f like 10.123400

%e like 1.123400e-03

fprintf Examples

```
x=3; y=4; z=50;
fprintf('This is a test ');
fprintf('num1=%d   num2=%f   num3=%e',x,y,z);
```

```
This is a test num1=3   num2=4.000000    num3=5.000000e+01
```

```
z=501
fprintf('%d,%f,%e',z,z,z);
```

```
501,501.000000,5.010000e+02
```

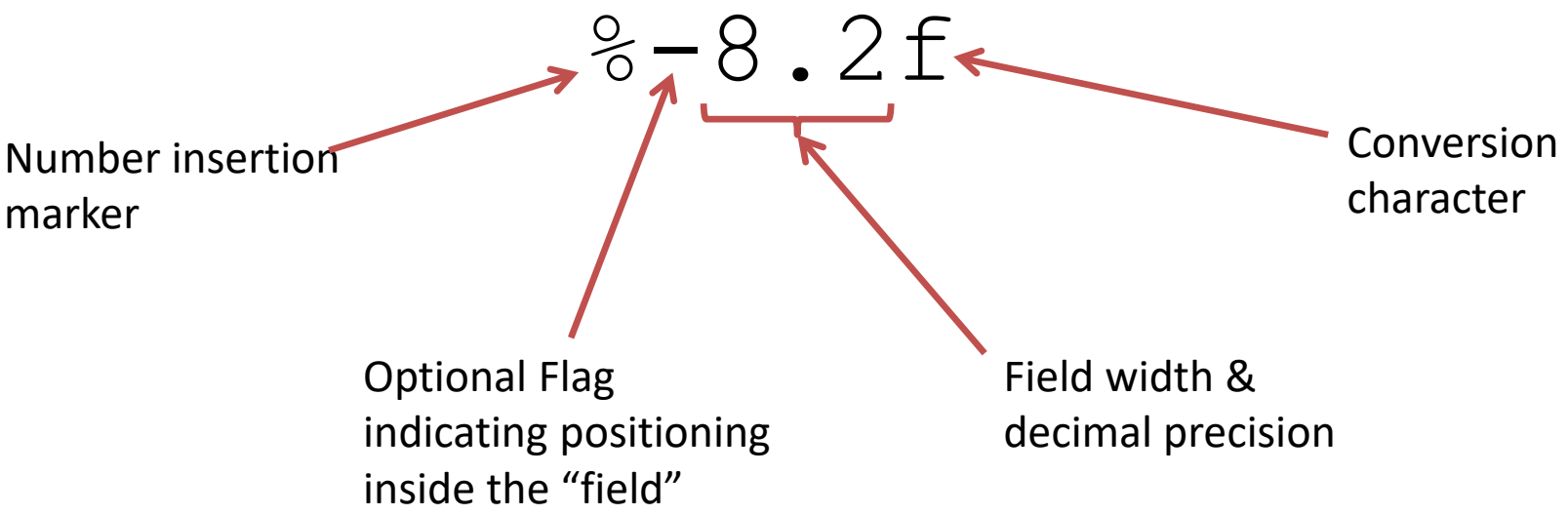
fprintf Escape characters

- To display a “%”, use ‘`%%`’ in fprintf’s `format`
- To move to new line use \n
- To display backslash use ‘\\’
- To display single quotation use two single quotations

```
x=3;
fprintf(‘This is a test \n’);
fprintf(‘ ‘’ num1=%d/100 = %f %%   \\ ‘’ ’,x,x/100);
```

This is a test
‘ num1=3/100 = 0.030000% \ ’

`fprintf` function



fprintf %f Examples

```
x=3.1253;
fprintf('X= %10.3f, %.0f, %%\n',x,x);
fprintf('x= %-10.3f, %.0f, \n %%\n',x,x);
fprintf('x= %-10.2f, %f\n',x,x);
```

X	=						3	.	1	2	5	,	3	,	%						
x	=	3	.	1	2	5						,	3	,							
%																					
x	=	3	.	1	3							,	3	.	1	2	5	3	0	0	

fprintf a table

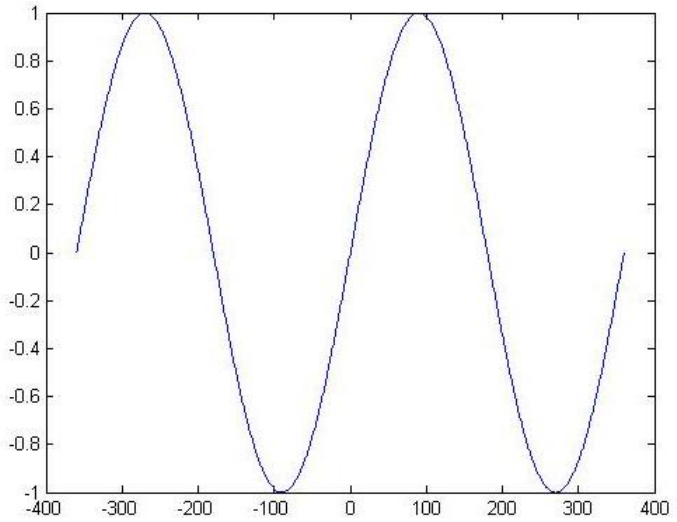
```
fprintf('Angle    Sin\n');
for d=-90:10:90
        r=d*pi/180;
        s=sin(r);
        fprintf('%-10d %-10.2f\n',d,s);
end
```

Angle	Sin
-90	-1.00
-80	-0.98
-70	-0.94
-60	-0.87
-50	-0.77
-40	-0.64
-30	-0.50
-20	-0.34
-10	-0.17
0	0.00
10	0.17
20	0.34
30	0.50
40	0.64
50	0.77
60	0.87
70	0.94
80	0.98
90	1.00

Plotting 2D graph

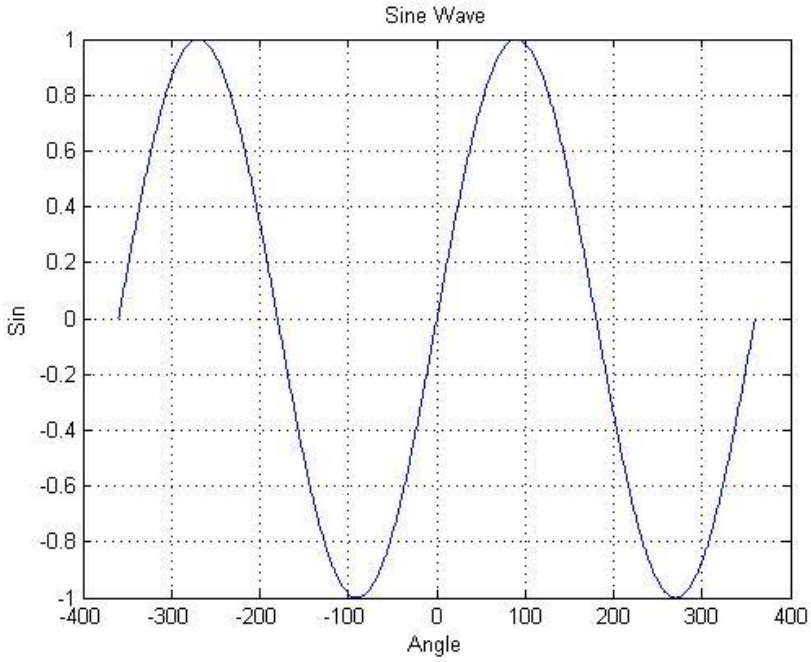
```
i=1;
fprintf('Angle    Sin\n');
for d=-360:1:360
    r=d*pi/180;
    s(i)=sin(r);
    a(i)=d;
    fprintf('%-10d%-10.2f\n',d,s(i));
    i=i+1;
end
plot(a,s);
```

Try it in MATLAB



Plotting 2D graph (Adding title and labels)

```
i=1;
fprintf('Angle    Sin\n');
for d=-360:360
   r=d*pi/180;
   s(i)=sin(r);
   a(i)=d;
   fprintf('%-10d %-10.2f\n',d,s(i));
   i=i+1;
end
plot(a,s);
title('Sine Wave');
xlabel('Angle'); ylabel('Sin');
grid;
```



Try it in MATLAB

Saving to a file

```
f=fopen('test.txt','w');    % Open/create a file named test.txt for writing
i=1;
fprintf(f,'Angle    Sin\n');          %write to the opened file
for d=-360:360
        r=d*pi/180;
        s(i)=sin(r);
        a(i)=d;
        fprintf(f,'%-10d%-10.2f\n',d,s(i));
        i=i+1;
end
plot(a,s);
fclose(f);                  % close the opened file
```

Try it in MATLAB and check the file test.txt

Thank You

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