Flow Control & Logic in Matlab

ChEn 1703

See Chapter 4 in your text book.

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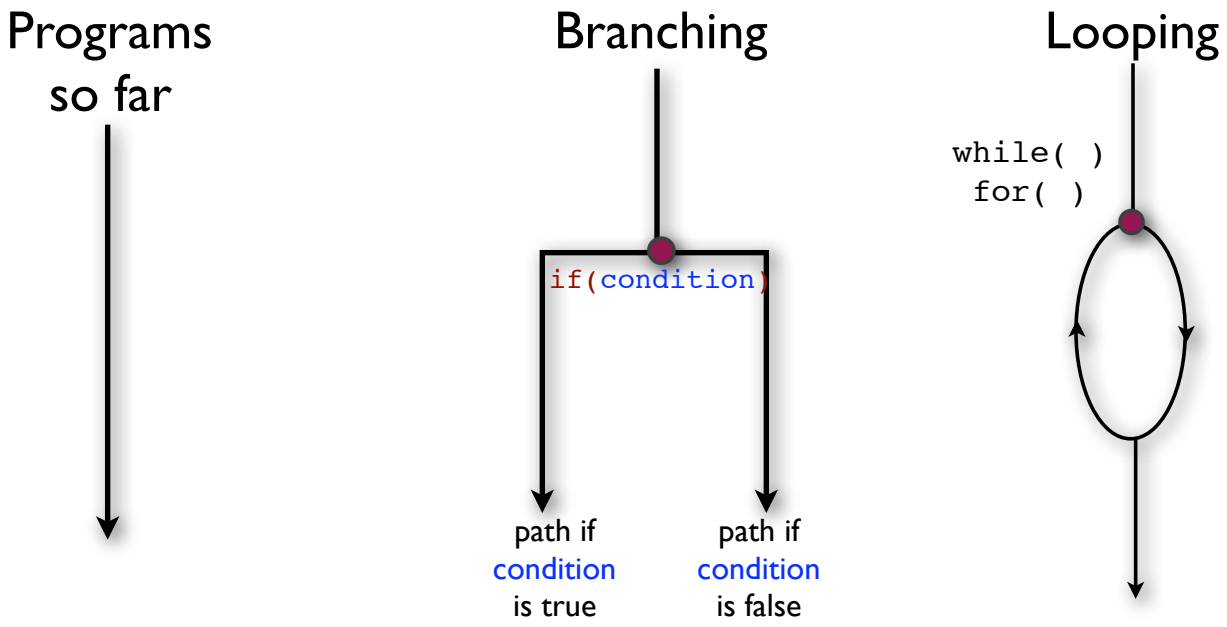
Basic Concepts

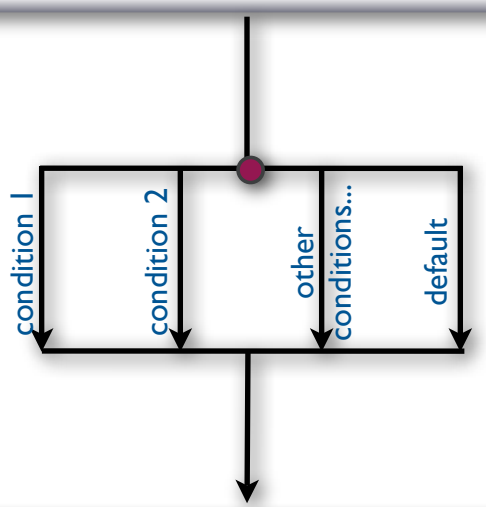


These basic elements can be combined to create complex program logic.

The "if" Statement

Basic syntax:

```
if ( condition1 )
  % do some work
elseif ( condition2 )
  % do different work
⋮
else
  % do default work
end
```




```
if ( condition )
  % do some work
end
```

```
if ( condition )
  % do some work
else
  % do default work
end
```

Create a MATLAB script to plot cos(x) an sin(x) on a user-specified interval. The user should be able to enter the interval in degrees or radians.

Palm p. 191-195

Relational Operators

- True condition represented by a nonzero (typically "1").
- False condition represented by zero "0"
- Can be applied to scalars, vectors, or matrices.

Statement	Result	Example
`a == b`	true if a and b are equal	5==3 false
`a ~= b`	true if a and b are NOT equal	5~=3 true
`a < b`	true if a is less than b	5<3 false
`a > b`	true if a is greater than b	5>3 true
`a >= b`	true if a is not less than b	5>=3 true
`a <= b`	true if a is not greater than b	5<=3 false

Comparison Operators

Palm p. 194

Operator	Description
&	Element-wise AND - returns an array of 1 and 0.
|	Element-wise OR - returns an array of 1 and 0
~	Element-wise NOT - returns an array of 1 and 0

Logical Operators

Example: What does this do?

```
dice = 3*rand(1);  % a number between 0 and 3
if( dice<1 )
  name = 'Bob';
elseif (dice<2)
  name = 'Fred';
else
  name = 'Jane';
end

dice = 3*rand(1);  % a number between 0 and 3
if dice<1
  age = 25;
elseif dice<2
  age=19;
else
  age = 40;
end

fprintf('\n%s is %1.0f years old\n\n',name,age);
```

A Few More Useful Functions

Function	Description
any(var)	returns true if any element of var is true
all(var)	returns true (1) if all elements of var are true.
find(var)	returns the indices where var is true (nonzero).
isequal(var1, var2)	returns true (1) if the two arrays are equal.
strcmp(str1,str2)	Compares two strings and returns true if they are equal.
abs(var)	returns the absolute value of all elements of var.
ceil(var)	rounds all elements of var up.
floor(var)	rounds all elements of var down.
mod(var1,var2)	Remainder of division of var1 by var2.

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Example - Data Analysis

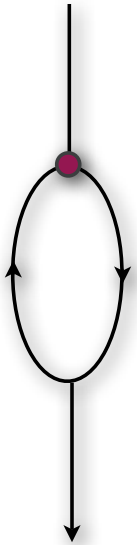
- Generate a set of random numbers between 1 and 100.
  - What percentage of these numbers are between 40 and 60?
  - How many numbers did it take to get a consistent answer?
- Repeat this example to determine what percentage are between 90 and 95.
- Hint: use the **`rand`** function.

The "for" Statement

Predetermined looping

Basic syntax:

```
for(counter=start:step:stop)
  % do some work
end
```



increment counter by step each time loop is executed.

Example - what are the values in a?

```
n=5;
a = zeros(n,1);
for i=1:n
  a(i) = 2*i;
end
```

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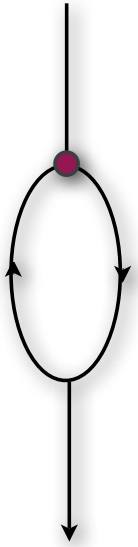
The "while" Statement

Conditional Looping

Basic syntax:

```
while ( condition )
  % do some work - must result
  % in condition being changed
  % at some point!
end
```



check condition each time loop is executed.

Example - What is the value of n?

```
a = 1;
n = 0;
while (a<10 )
   a = a+2;
   n = n+1;
end
```

Example: Factorial

$$n! = \prod_{i=1}^{n} i$$

Write a Matlab code to calculate the factorial of a number using:

1. A **`for`** loop
2. A **`while`** loop

NOTE: MATLAB's factorial function will do this much faster than using loops will.

Example: Vector Operations

Define two vectors. Have the user choose one of two options:

1. Calculate the dot product of two vectors *using loops*
2. Calculate the elemental product of two vectors *using loops*.

Example: Craps

Given a "bet," determine how many rolls of the dice you must have to win.

- Two dice: what bets are allowable? (Prevent invalid bets)
- How would we set this up?