Previous class:
- Intro to computer programming
- Variables & assignment
- Input & output
- Script
- Calling functions for graphics

Now:
- Branching
- Nested statements

A script (program) is a file with a sequence of commands

```
# Quadratic equation solver
a = input('Enter a: ');
b = input('Enter b: ');
c = input('Enter c: ');
d = b^2 - 4*a*c;
r1 = (-b-sqrt(d))/(2*a);
r2 = (-b+sqrt(d))/(2*a);
```

Comment begins with `%`

Variable holds a value

Semi-colon suppresses "echo"

A file with extension `.m`

The if-else construct
```
if d >= 0
    r1 = (-b-sqrt(d))/(2*a);
    r2 = (-b+sqrt(d))/(2*a);
else
    fprintf('Complex roots
')
end
```

File: qSolver.m

Relational operators
```
<  Less than
>  Greater than
<=  Less than or equal to
>=  Greater than or equal to
==  Equal to
~=  Not equal to
```

Suppose I don't care about the values of the roots—I just want to know if the roots are complex.
```
# Quadratic equation solver
a = input('Enter a: ');
b = input('Enter b: ');
c = input('Enter c: ');
d = b^2 - 4*a*c;
if d < 0
    fprintf('Complex roots\n')
end
```
The **if** construct

```
if <condition>
    statements to execute if condition is true
end
```

**Logical AND**

Q. When is a real number $x$ in the interval $[L,R]$?

A. If $x$ is greater than or equal to $L$ and less than or equal to $R$.

```c
if (x>=L && x<=R)
    fprintf('x is in [L,R]')
else
    fprintf('x is not in [L,R]')
end
```

**Logical OR**

Q. When is a real number $x$ not in the interval $[L,R]$?

A. If $x$ is less than $L$ or less greater than $R$.

```c
if (x<L || x>R)
    fprintf('x is not in [L,R]')
else
    fprintf('x is in [L,R]')
end
```

**Boolean expressions**

- They involve comparisons.
- They have a value that can be thought of as either true or false.

Example:

1. Variables $a$, $b$, and $c$ have positive real values. Can we make a triangle with sides that have those values? Yes if the following is true:

2. Variable $x$ has a positive integer value. Is it divisible by 3 and 5? Yes if the following is true:
3. Variable y has a positive integer value. Does it name a non-leap year? Yes if the following is true:

Hint: Y is an “ordinary” year if it is not divisible by 4 or if it is a century year not divisible by 400.

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### Logical operators “short-circuit”

- `a > b && c > d`
  - true
  - `Do A && condition short-circuits to false if the left operand evaluates to false.`
  - false
  - `Stop`  
  - Entire expression is false since the first part is false

---

### “false” is 0, “true” is non-zero

X, Y represent boolean expressions. 
E.g. d > 3.14

| X | Y | X && Y | X || Y | ~X |
|---|---|-------|-------|----|
| 1 | 1 | 1     | 1     | 0  |
| 1 | 0 | 0     | 1     | 0  |
| 0 | 1 | 0     | 1     | 0  |
| 0 | 0 | 0     | 0     | 1  |

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% Find number of days in month m

```matlab
m = input('Which month? '); % Fill in the necessary code.  
There are 3 possibilities: 30, 31, or 28 days.  
So we need to choose 1 among 3 options.
```

```matlab
fprintf("Month %d has %d days\n",...  
m, days);
```

---

% Find number of days in month m

```matlab
m = input('Which month? ');  
if m==2  
  days= 28;  
else  
  if rem(m,2)==1 && m<=7 ||...  
    rem(m,2)==0 && m>=8  
    days= 31;  
  else  
    days= 30;  
  end
```

```matlab
fprintf("Month %d has %d days\n",...  
m, days);
```

---

% Find number of days in month m

```matlab
m = input('Which month? ');  
if m==2  
  days= 28;  
else  
  if rem(m,2)==1 && m<=7 ||...  
    rem(m,2)==0 && m>=8  
    days= 31;  
  else  
    days= 30;  
  end
end
```

```matlab
fprintf("Month %d has %d days\n",...  
m, days);
```
The if-elseif-else construct

if <condition 1>
    statements to execute if condition 1 is true
elseif <condition 2>
    statements to execute if condition 2 is true
elseif <condition 3>
    statements to execute if condition 3 is true
else
    statements to execute if condition 3 is false
end

Use this construct when there are many alternatives. Only one block of statements will be executed.

Things to know about the if construct

- At most one branch of statements is executed
- There can be ________ elseif clauses
- There can be ________ else clause
- The else clause ___________ in the construct
- The else clause _________________ (boolean expression)

Does this program work?

score= input('Enter score: ');
if score>55
    disp('D')
elseif score>65
    disp('C')
elseif score>80
    disp('B')
elseif score>93
    disp('A')
else
    disp('Not good…')
end

A: yes
B: no