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

Now:
- Branching

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

```matlab
% 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)
```

Another version of the program...

```matlab
% Quadratic equation solver
a= input('Enter a: ');
b= input('Enter b: ');
c= input('Enter c: ');
d= b^2 -4*a*c;
if d >= 0
    r1= (-b-sqrt(d))/(2*a)
r2= (-b+sqrt(d))/(2*a)
else
    fprintf('Complex roots\n')
end
```

The **if-else** construct

```matlab
if <condition>
    statements to execute if condition is true
else
    statements to execute if condition is false
end
```

Relational operators

- `<` Less than
- `>` Greater than
- `<=` Less than or equal to
- `>=` Greater than or equal to
- `==` Equal to
- `~=` Not equal to
% 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
')
end

Suppose I don’t care about the values of the roots—I just want to know if the roots are complex.

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 $R$.

```
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 $R$.

```
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:

```
if (a+b>c && a+c>b && b+c>a)
    fprintf('Can make triangle')
else
    fprintf('Cannot make triangle')
end
```
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.

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

“false” is 0, “true” is non-zero

Always use logical operators for multiple conditions

Why is it wrong to use the expression

\[ L \leq x \leq R \]

for checking if \( x \) is in \([L,R]\)?

Example: Suppose \( L \) is 5, \( R \) is 8, and \( xc \) is 10. We know that 10 is not in [5,8], but the expression

\[ L \leq xc \leq R \]

gives...

% Find number of days in month m
m= input('Which month? ');

fprintf('Month %d has %d days
', m, days);

The if-elseif-else construct

```matlab
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.

% Find number of days in month m
m= input('Which month? ');

if (m==2)
    days= 28;
elseif ( rem(m,2)==1 && m<=7 || rem(m,2)==0 && m>=8   )
    days= 31;
else
    days= 30;
end

fprintf('Month %d has %d days
', m, days);

% Find number of days in month m
m= input('Which month? ');

if (m==2)
    days= 28;
elseif ( rem(m,2)==1 && m<=7 || rem(m,2)==0 && m>=8   )
    days= 31;
else
    days= 30;
end

fprintf('Month %d has %d days
', m, days);

Fill in the necessary code.

There are 3 possibilities: 30, 31, or 28 days. So we need to choose 1 among 3 options.

fprintf('Month %d has %d days\n', m, days);
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?

```matlab
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
```

% Find number of days in month m
m= input('Which month? '); if m==2
days= 28;
elseif rem(m,2)==1 & m<=7 || ...
rem(m,2)==0 & m>=8
days= 31;
else
days= 30;
end
fprintf('Month %d has %d days\n',... m, days);

% Find number of days in month m
m= input('Which month? '); if m==2
days= 28;
else  % All months other than Feb
if rem(m,2)==1 & m<=7 ||...
rem(m,2)==0 & m>=8
days= 31;
else
days= 30;
end
end
fprintf('Month %d has %d days\n',... m, days);