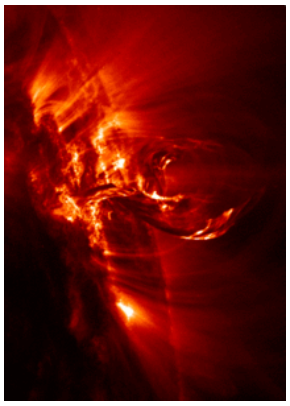


More Branching, More Conditionals, Built-In Functions

Lecture 4 (Feb 1)
CS100M – Spring 2007

Announcements

- Project 2
  - Due Thursday, Feb 15
  - Should appear online by this weekend
- For this next week, section will be in the classroom instead of the lab

Topics

- Recall previous lecture
  - Branching (if-statements)
  - Comparisons
- Plans for today
  - More branching
  - Logical operations
  - Some useful built-in functions

Several Forms of if-Statement

- Short

```
if condition
    statements
end
```

- Medium

```
if condition
    statements
else
    statements
end
```

- Long

```
if condition
    statements
elseif condition
    statements
elseif condition
    statements
else
    statements
end
```

Playing with Comparisons

- Suppose x has the value 5
  - What is the result of typing
    `x < 10`
    in the Matlab Command Window?

    A: false
  - What is the result of typing
    `6 < x`
    in the Matlab Command Window?

    B: true
  - What is the result of typing
    `6 < x < 10`
    in the Matlab Command Window?

Logical Constructs

- Which of these conditional expressions tests for a valid measurement of less than 12 inches?

A: x < 12 && x >= 0

B: 0 <= x || x < 12

C: ~(x < 0 || x >= 12)

D: all of the above

Short-Circuit Operators

- && (and) and || (or) are both short-circuit operators
  - Once the answer is known the remaining part of the expression is not evaluated
- Example

```
x >= 0   &&   sqrt(x) > 2.5
```

  - If x is less than 0 then the square root is never calculated
- There are non-short-circuit versions (& and |), but you should normally use the short-circuit version

Some Built-In Functions

- Most standard mathematical functions are available
  - When in doubt type **`help functionName`** in the Command Window
- Trigonometric functions (using radians, not degrees)
  - sin
  - cos
  - tan
  - asin (inverse sin)
  - acos (inverse cos)
  - atan (inverse tan)
- Log, exponential functions
  - exp (exponential)
  - log (natural logarithm)
  - log10 (base-10 logarithm)
  - log2 (base-2 logarithm)
  - Also, `x^p` computes x^p
- Functions for integer computation
  - floor
  - ceil
  - round
  - fix
  - mod
- A few more: max, min, abs

floor

p = floor(x)

- p is assigned the largest integer less than or equal to x

floor(-3.5) has the value -4
floor(3.5) has the value 3
floor(5) has the value 5
floor(3.2) has the value 3
floor(3.7) has the value 3

ceil

p = ceil(x)

- p is assigned the smallest integer greater than or equal to x

ceil(-3.5) has the value -3
ceil(3.5) has the value 4
ceil(5) has the value 5
ceil(3.2) has the value 4
ceil(3.7) has the value 4

round

p = round(x)

- p is assigned the integer that is closest to x
  - In case of a tie, use the integer that is farther from 0

round(-3.5) has the value -4
round(3.5) has the value 4
round(5) has the value 5
round(3.2) has the value 3
round(3.7) has the value 4

fix

p = fix(x)

- p is assigned the closest integer between 0 and x (i.e., round toward 0)

fix(-3.5) has the value -3
fix(3.5) has the value 3
fix(5) has the value 5
fix(3.2) has the value 3
fix(3.7) has the value 3

mod

r = mod(p, q)

- r is assigned the remainder when we divide p by q

mod(5, 2) has the value 1
mod(704, 10) has the value 4
mod(30, 7) has the value 2

Boolean Expression Example

- To test if x is divisible by both 3 and 5

```
if (mod(x, 3) == 0 && mod(x, 5) == 0)
   disp('Divisible by both')
else
   disp('Not divisible by both')
end
```

Another Boolean Expression Example

- To test if integer y represents a Leap Year
  - Year y is a Leap Year if
    - It is divisible by 4
    - Exception: century years are *not* Leap Years
    - Exception: years divisible by 400 *are* Leap Years
- Write a program to determine if a given year is a Leap Year

Revisiting the Min-Finding Program

```
% Determine min value of q(x) = x^2 + b*x + c
% in the interval [L, R]
xc = - b/2;          % Compute x_c
if (L <= xc && xc <= R)
   minValue = xc^2 + b*xc + c;
else                 % Compute min of q(L) and q(R)
   minValue = min(L^2 + b*L + c, R^2 + b*R + c);
end
fprintf('Min value is %f\n', minValue)
```

Playing with Built-In Functions

- What is round(round(16/3)/3)?

A: 1 | B: 2 | C: 3

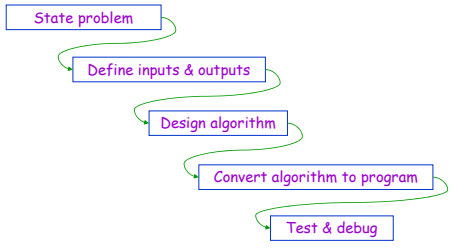
- What is floor(floor(16/3)/3)?

A: 1 | B: 2 | C: 3

- What is ceil(ceil(16/3)/3)?

A: 1 | B: 2 | C: 3

Creating a Program



- An algorithm is an *idea*
- To use an algorithm you must choose a programming language and *implement* the algorithm