Previous topics:
- Branching
- Boolean expressions

Now:
- Introduction to for-loop

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**Question**

A stick of unit length is split into two pieces. The breakpoint is randomly selected. On average, how long is the shorter piece?

**Physical experiment?**
**Thought experiment? → analysis**
**Computational experiment! → simulation**

*Need to repeat many trials!*

---

% one trial of the experiment
breakPt = rand;
if breakPt<0.5
    shortPiece = breakPt;
else
    shortPiece = 1-breakPt;
end

---

% one trial of the experiment
breakPt = rand;
shortPiece = min(breakPt, 1-breakPt);

Want to do many trials, add up the lengths of the short pieces, and then divide by the number of trials to get the average length.

---

n= 10000;  % number of trials
total= 0;  % accumulated length so far
for k= 1:n
  % one trial of the experiment
  breakPt = rand;
  shortPiece = min(breakPt, 1-breakPt);
  total = total + shortPiece;
end
aveLength= total/n
fprintf('Average length is %f
', aveLength)
Monte Carlo Estimation of $\pi$

- Throw $N$ darts
- Square area = $N = L \times L$
- Circle area = $N_{\text{in}} = \pi \frac{L^2}{4}$
- $\pi = 4 \frac{N_{\text{in}}}{N}$

Monte Carlo Approximation of $\pi$

For each of $N$ trials
- Throw a dart
- If it lands in circle, add 1 to total # of hits
- $\pi$ is $4 \cdot \text{hits}/N$

Monte Carlo Pi with $N$ darts on $L$-by-$L$ board

```matlab
for k = 1:N
    % Throw kth dart
    % Is it in the circle?
end
myPi = 4*hits/N;
```

Syntax of the `for` loop

```matlab
for <var> = <start value>:<incr>:<end bound>
    statements to be executed repeatedly
end
```

Loop header specifies all the values that the index variable will take on, one for each pass of the loop.
E.g., `k = 3:1:7` means `k` will take on the values 3, 4, 5, 6, 7, one at a time.

Pattern for doing something $n$ times

```matlab
for k = 1:n
    % code to do that something
end
```

for loop examples

```matlab
for k = 2:0.5:3
    disp(k)
end
for k = 1:4
    disp(k)
end
for k = 0:-2:-6
    disp(k)
end
for k = 0:-2:-7
    disp(k)
end
for k = 5:2:1
    disp(k)
end
```

- $k$ takes on the values __________
- Non-integer increment is OK
- Default increment is 1
- “Increment” may be negative
- Colon expression specifies a bound
- $k$ takes on the values __________
- $k$ takes on the values __________