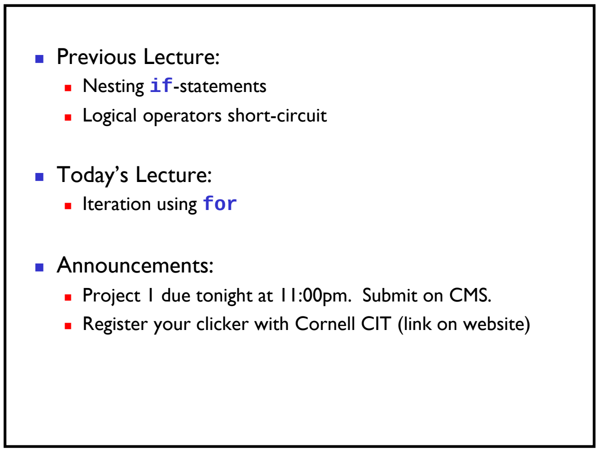
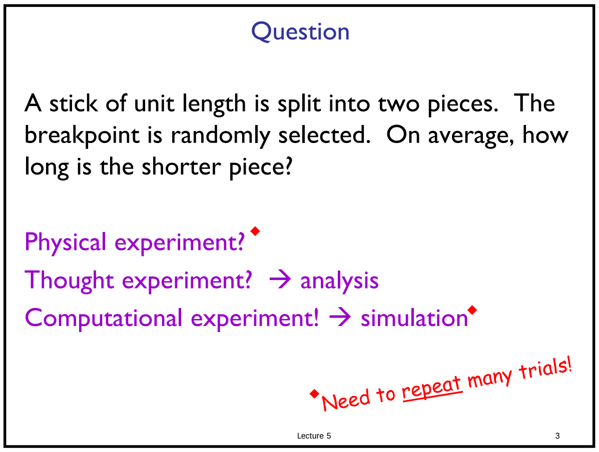


- Previous Lecture:
  - Nesting `if`-statements
  - Logical operators short-circuit
- Today's Lecture:
  - Iteration using `for`
- Announcements:
  - Project 1 due tonight at 11:00pm. Submit on CMS.
  - Register your clicker with Cornell CIT (link on website)



Question

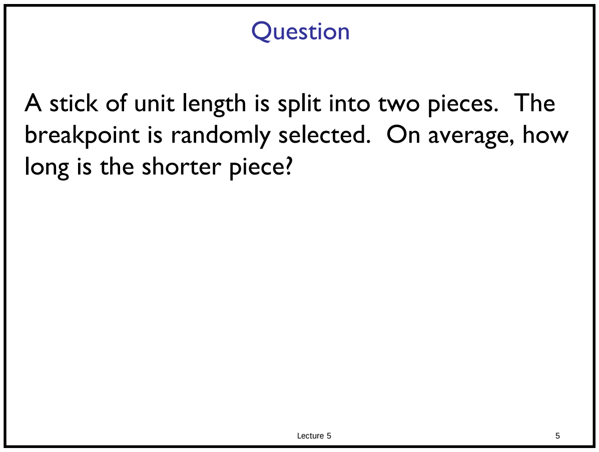
A stick of unit length is split into two pieces. The breakpoint is randomly selected. On average, how long is the shorter piece?

Physical experiment?◆

Thought experiment? → analysis

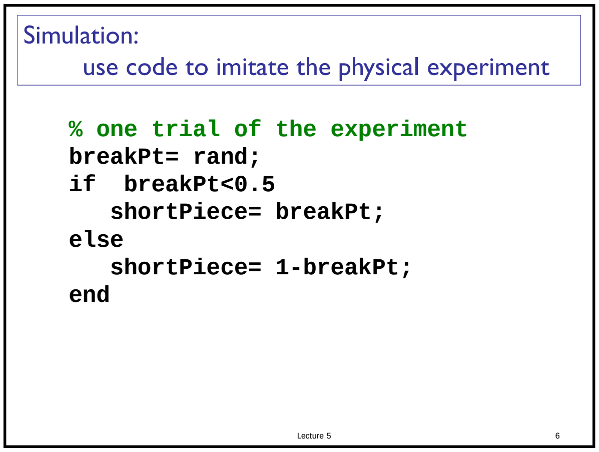
Computational experiment! → simulation◆

◆Need to repeat many trials!



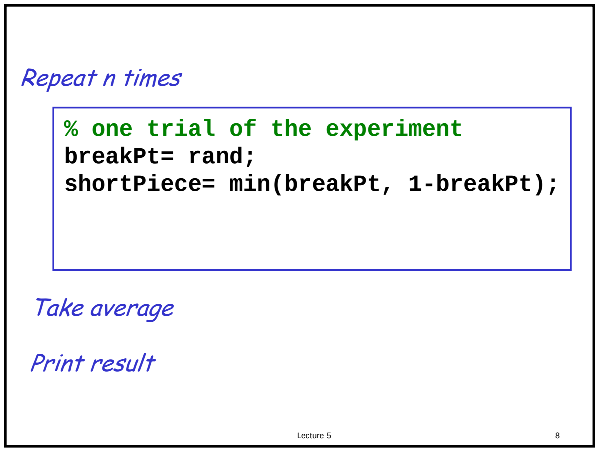
Question

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



Simulation:
use code to imitate the physical experiment

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

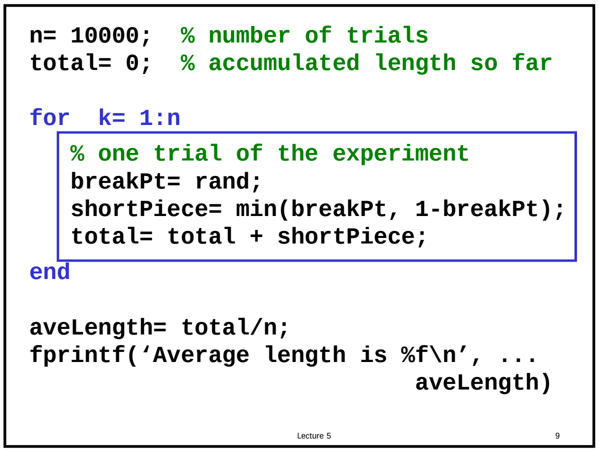


Repeat n times

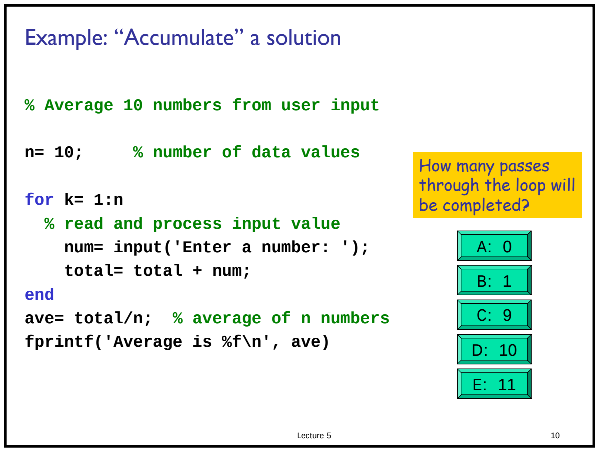
```
% one trial of the experiment
breakPt= rand;
shortPiece= min(breakPt, 1-breakPt);
```

Take average

Print result



```
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\n', ...
                             aveLength)
```

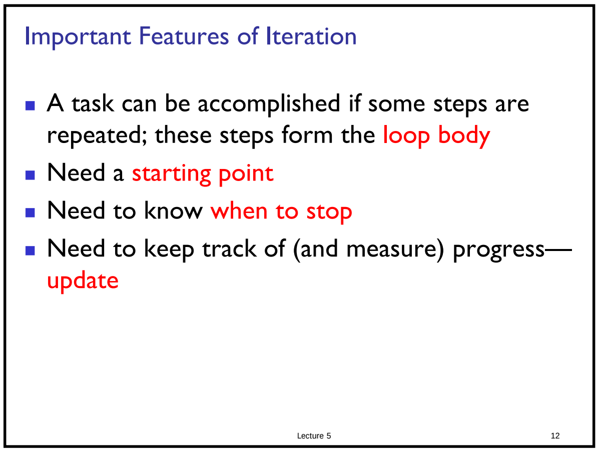


Example: “Accumulate” a solution

```
% Average 10 numbers from user input

n= 10;     % number of data values

for k= 1:n
  % read and process input value
    num= input('Enter a number: ');
    total= total + num;
end
ave= total/n;  % average of n numbers
fprintf('Average is %f\n', ave)
```

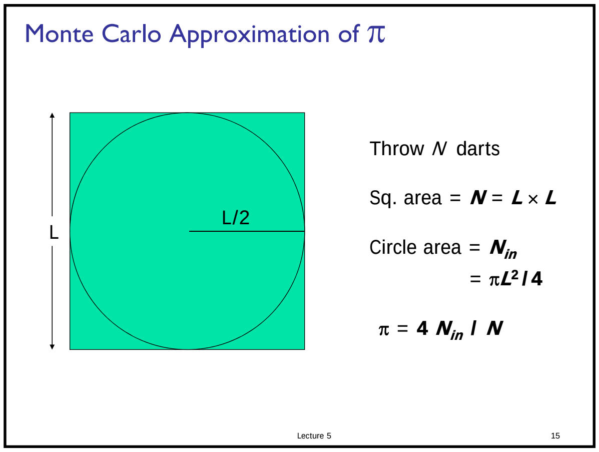
How many passes through the loop will be completed?

- A: 0
- B: 1
- C: 9
- D: 10
- E: 11



Important Features of Iteration

- A task can be accomplished if some steps are repeated; these steps form the loop body
- Need a starting point
- Need to know when to stop
- Need to keep track of (and measure) progress—update



Monte Carlo Approximation of π

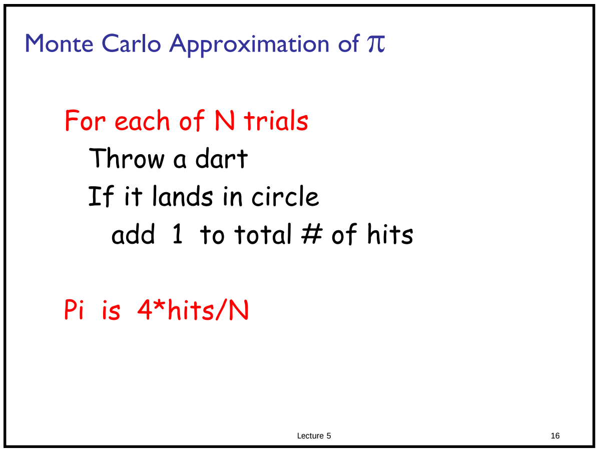
Throw N darts

Sq. area = $N = L \times L$

Circle area = N_{in}

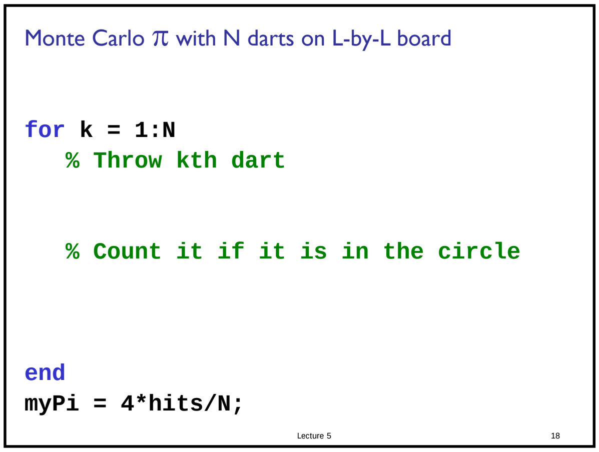
= $\pi L^2 / 4$

$\pi = 4 N_{in} / N$



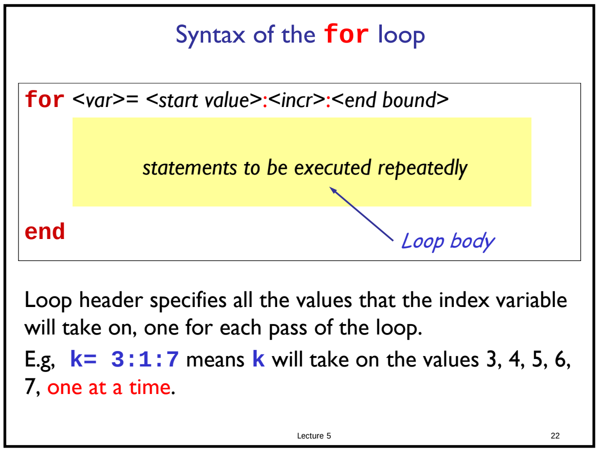
Monte Carlo Approximation of π

```
For each of N trials
  Throw a dart
  If it lands in circle
    add 1 to total # of hits

Pi is 4*hits/N
```



Monte Carlo π with N darts on L-by-L board

```
for k = 1:N
   % Throw kth dart


   % Count it if it is in the circle



end
myPi = 4*hits/N;
```



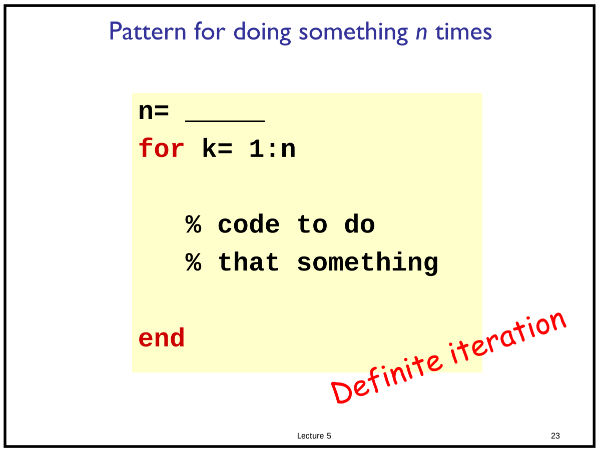
Syntax of the **for** loop

```
for <var>= <start value>:<incr>:<end bound>

    statements to be executed repeatedly

end
```

Loop body

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.

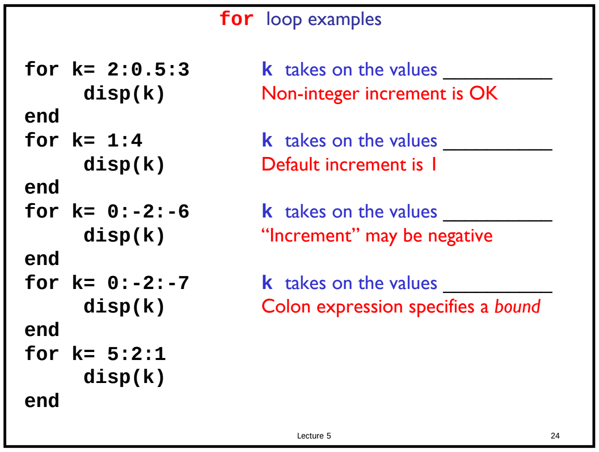


Pattern for doing something *n* times

```
n= ______
for k= 1:n

   % code to do
   % that something

end
```

Definite iteration

Lecture 5 23



for loop examples

```
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

k takes on the values ___________
Default increment is 1

k takes on the values ___________
"Increment" may be negative

k takes on the values ___________
Colon expression specifies a *bound*

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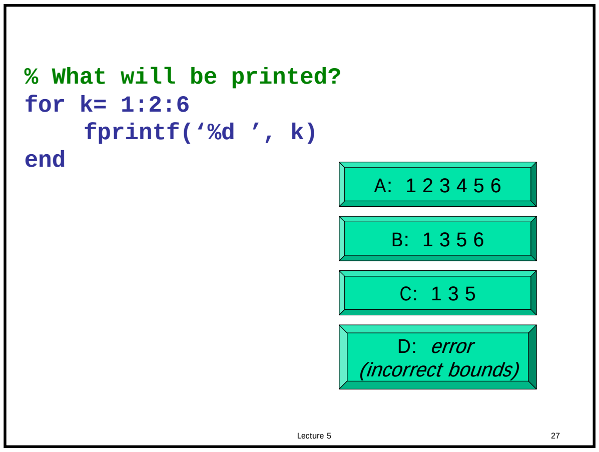

```
% What will be printed?
for k= 1:2:6
       fprintf('%d ', k)
end
```

A: 1 2 3 4 5 6

B: 1 3 5 6

C: 1 3 5

D: *error (incorrect bounds)*

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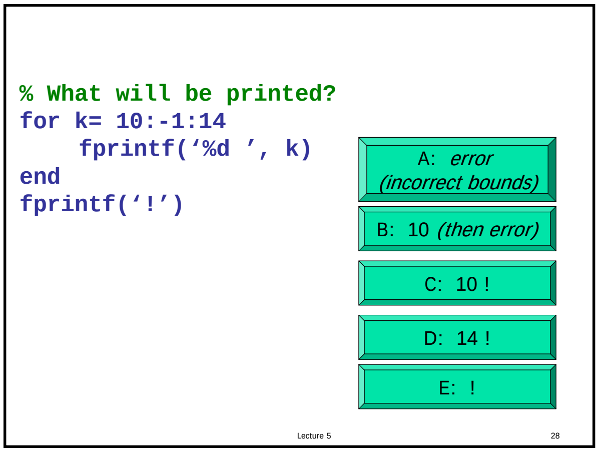

```
% What will be printed?
for k= 10:-1:14
       fprintf('%d ', k)
end
fprintf('!')
```

A: *error (incorrect bounds)*

B: 10 *(then error)*

C: 10 !

D: 14 !

E: !

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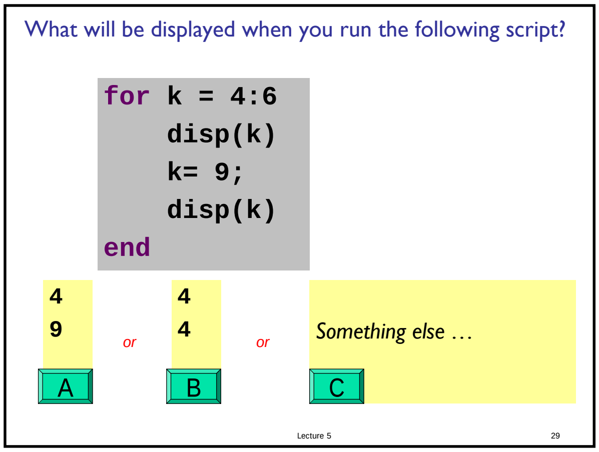

What will be displayed when you run the following script?

```
for k = 4:6
    disp(k)
    k= 9;
    disp(k)
end
```

4
9

A

or

4
4

B

or

Something else …

C

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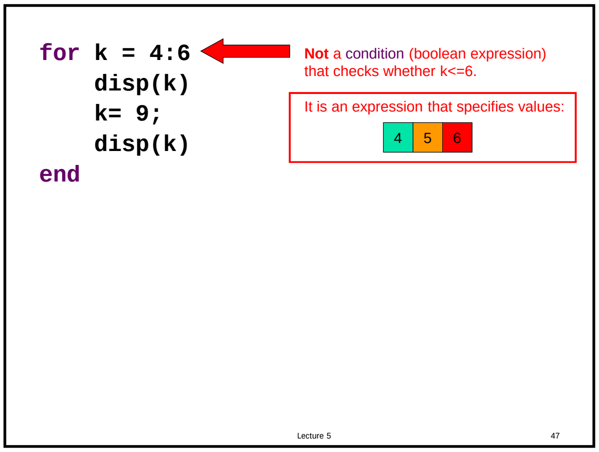

```
for k = 4:6
    disp(k)
    k= 9;
    disp(k)
end
```

Not a condition (boolean expression) that checks whether k<=6.

It is an expression that specifies values:

4	5	6

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