

# Loops

## Iteration with **for** loops



### **CS112 Scientific Computation**

Department of Computer Science  
Wellesley College

## Iteration

We often want to **repeat** an operation multiple times or step through a collection of values and *perform the same computation for each value*

For example:

- drawing the olympic symbol
- cleaning up the depth data
- recognizing faces



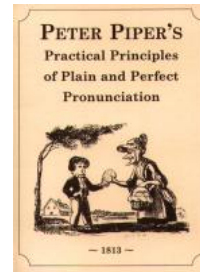
## Repetitive computations

Repetitive computations can be implemented with a `for` statement:

```
for variable name = vector of values
    code statements to repeat
end
```

For example:

```
for count = 1:5
    disp('Peter Piper picked a peck of pickled peppers');
end
```



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## Let's turn `peterPiper` into a function

```
function peterPiper
% peterPiper
% repeats a tongue twister 5 times
for count = 1:5
    disp('Peter Piper picked a peck of pickled peppers');
end
```

Modify `peterPiper` so the number of repeats is an input:

```
>> peterPiper(4)
Peter Piper picked a peck of pickled peppers
Peter Piper picked a peck of pickled peppers
Peter Piper picked a peck of pickled peppers
Peter Piper picked a peck of pickled peppers
>>
```

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## Further modifications to peterPiper

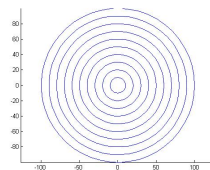
Modify `peterPiper` function further so the value of the count variable is incorporated into the printout:

```
>> peterPiper(3)      hmmm?  
Peter Piper picked 1 pecks of pickled peppers  
Peter Piper picked 2 pecks of pickled peppers  
Peter Piper picked 3 pecks of pickled peppers
```

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## Creating a bull's eye display

```
function makeBullseye  
% creates a display of 10 blue concentric circles  
% create 50 evenly spaced angles around a circle  
angles = linspace(0, 2*pi, 50);  
hold on  
% plot 10 circles of increasing radius  
for radius = 10:10:100  
    plot(radius*cos(angles), radius*sin(angles));  
end  
axis equal  
hold off
```



**Boring...**

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## Variety is the spice of life

```
function makeBullseye2
% creates a display of 10 multi-colored concentric circles

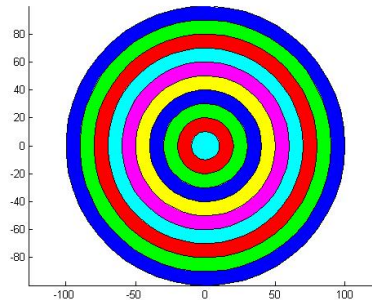
% create 50 evenly spaced angles around a circle
angles = linspace(0, 2*pi, 50);
% create a vector of different colors from a string
colors = 'bgrcmymbgrc';
hold on
% plot 10 circles of increasing radius and changing color
index = 1;
for radius = 10:10:100
    plot(radius*cos(angles), radius*sin(angles), colors(index));
    index = index + 1;
end
axis equal
hold off
```

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## Better still?

How about a real Bull's eye pattern  
with the colors filled in?

We can use the `fill` function  
instead of `plot` to create a  
Bull's eye like this



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## Bull's eye!

```
function makeBullseye3
% creates a display of multi-colored concentric circles

% create 50 evenly spaced angles around a circle
angles = linspace(0, 2*pi, 50);
% create a vector of different colors from a string
colors = 'bgrcmymbgrc';
hold on
% plot 10 circles of increasing radius and changing color
for index = 10:-1:1
    fill(10*index*cos(angles), 10*index*sin(angles), colors(index));
end
axis equal
hold off
```

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## Breaking out

Sometimes we'd like to *immediately exit a loop* without stepping through all values of the control variable

We can do this with a **break** statement:

```
num = 1;
for i = 1:100
    num = 2 * num;
    if (num > 100)
        break;
    else
        disp(['num' num2str(num)])
    end
end
```



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## collectGoldenRatios

Write a function named `collectGoldenRatios`:

- (1) one input: maximum number of times to prompt the user for hand and forearm values
- (2) “for loop” that prompts the user for hand and forearm values, for input number of times, and stores the ratios in a vector
- (3) stop the loop if the user enters a 0 for the hand length
- (4) print message at the end with number of measurements entered



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## Tip on debugging loops



`% calculate 10! and print the result`

```
factorial = 0;
for num = 10:1:1
    disp('inside loop');
    factorial = factorial * num;
    disp(['num: ' num2str(num) 'factorial : ' num2str(factorial)])
end
disp(['10! = ' num2str(factorial)]);
```

Print statements  
are your friends!



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