

- Previous Lecture:
 - Iteration using `for`

- Today's Lecture:
 - Iteration using `while`
 - Review loops, conditionals using graphics

- Announcements:
 - Did you watch MatTV episode "*Troubleshooting Loops*"? Available on course website
 - Project 2 due Thursday, 9/17
 - We do not use `break` in this course
 - Read *Insight* Section 3.2 before your discussion section next week

What will be displayed when you run the following script?

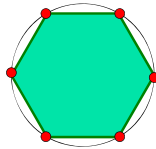
```

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

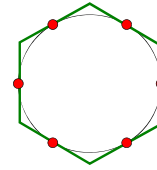
4
9
or
4
4
or
Something else ...

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Example: n -gon \rightarrow circle



Inscribed hexagon
 $(n/2) \sin(2\pi/n)$



Circumscribed hexagon
 $n \tan(\pi/n)$

As n approaches infinity, the inscribed and circumscribed areas approach the area of a circle.
When will $|OuterA - InnerA| \leq .000001$?

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Find n such that *outerA* and *innerA* converge

First, itemize the tasks:

- define how close is close enough
- select an initial n
- calculate *innerA*, *outerA* for current n
- $diff = outerA - innerA$
- close enough?
- if not, increase n , repeat above tasks

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Find n such that *outerA* and *innerA* converge

Now organize the tasks \rightarrow algorithm:

n gets initial value
innerA, *outerA* get initial values
 Repeat until difference is small:
 increase n
 calculate *innerA*, *outerA* for current n
 $diff = outerA - innerA$

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Find n such that *outerA* and *innerA* converge

n gets initial value
 calculate *innerA*, *outerA* for current n
 while <difference is not small enough>
 increase n
 calculate *innerA*, *outerA* for current n
 $diff = outerA - innerA$
 end

Indefinite iteration

areaCircle.m

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Guard against infinite loop

Use a loop guard that guarantees termination of the loop. Or just limit the number of iterations.

```
while (B_n-A_n >delta && n<nMax)
```

Eg2_2.m

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Another use of the while-loop: user interaction

- Example: Allow a user to repeatedly calculate the inscribed and circumscribed areas of n-gons on a unit circle.
- Need to define a “stopping signal”

areaIndef.m

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Common loop patterns

Do something *n* times

```
for k= 1:1:n
    % Do something
end
```

Do something an indefinite number of times

```
%Initialize loop variables
while ( not stopping signal )
    % Do something
    % Update loop variables
end
```

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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

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In Matlab, which claim is true? (without break)

- A:** for-loop can do anything while-loop can do
- B:** while-loop can do anything for-loop can do
- C:** for- and while-loops can do the same things

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for-loop or while-loop: that is the question

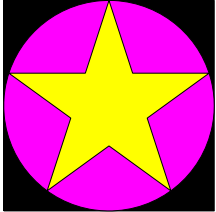
- for-loop: loop body repeats a *fixed* (predetermined) number of times.
- while-loop: loop body repeats an *indefinite* number of times under the control of the “loop guard.”

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Review loops/conditionals using user-defined graphics function

Draw a black square;
 then draw a magenta disk;
 then draw a yellow star.

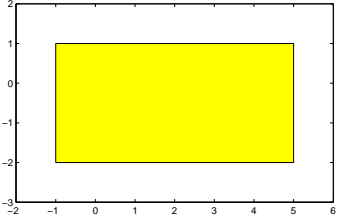


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x and y coordinates of lower left corner width height

`DrawRect(-1,-2,6,3,'y')`

color

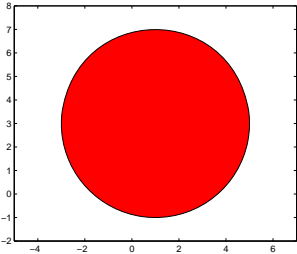


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x and y coordinates of the center radius

`DrawDisk(1,3,4,'r')`

color

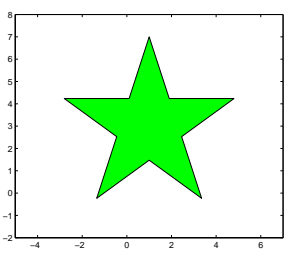


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x and y coordinates of the center "radius"









`DrawStar(1,3,4,'g')`

color



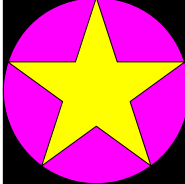
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Color Options

White	<code>'w'</code>	
Black	<code>'k'</code>	
Red	<code>'r'</code>	
Blue	<code>'b'</code>	
Green	<code>'g'</code>	
Yellow	<code>'y'</code>	
Magenta	<code>'m'</code>	
Cyan	<code>'c'</code>	

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```
% drawDemo
close all
figure
axis equal off
hold on
```



```
DrawRect(0,0,2,2,'k')
DrawDisk(1,1,1,'m')
DrawStar(1,1,1,'y')
```

hold off

A general graphics framework

```
% drawDemo
close all
figure
axis equal off
hold on
```

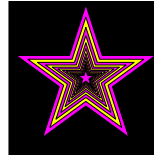
Code fragment to draw the objects (rectangle, disk, star)

```
hold off
```

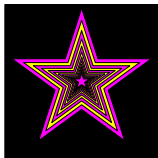
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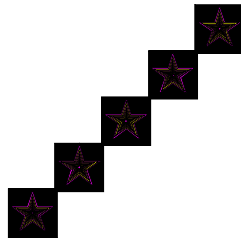
Example: Nested Stars



Knowing how to draw



How difficult is it to draw



Pattern for doing something n times

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

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```
x=0; y=0; % figure centered at (0,0)
s= 2.1; % side length of square
DrawRect(x-s/2,y-s/2,s,s,'k')
r= 1; k= 1;
while r > 0.1 %r still big
    % draw a star
    if rem(k,2)==1 %odd number
        DrawStar(x,y,r,'m') %magenta
    else
        DrawStar(x,y,r,'y') %yellow
    end
    % reduce r
    r= r/1.2;
    k= k + 1;
end
```