

Computer science is:

- ▶ programming
- ▶ algorithms and computation
- ▶ efficiency and correctness
- ▶ user-interface and user-experience
- ▶ applications (robots, machine learning, data science...)

Computer science is:

- ▶ **programming**
- ▶ algorithms and computation
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Programming languages:

- ▶ C
- ▶ C++
- ▶ C#
- ▶ HTML/CSS
- ▶ Java
- ▶ Javascript
- ▶ Objective-C
- ▶ Perl
- ▶ PHP
- ▶ Python
- ▶ Ruby
- ▶ SQL
- ▶ ...

Programming languages:

- ▶ C
- ▶ C++
- ▶ C#
- ▶ **HTML/CSS**
- ▶ Java
- ▶ **Javascript**
- ▶ Objective-C
- ▶ Perl
- ▶ **PHP**
- ▶ Python
- ▶ Ruby
- ▶ **SQL**
- ▶ ...

algorithm

a precise sequence of simple steps to solve a problem

code

translating an algorithm into a set of instructions that can be
executed by a computer



```
1 print( 42 );
```



```
1 print( 42 );
```




```
1 print( 42 );
```

42

```
print( 42 );
```

command

```
print(42);
```

parameter

```
print( 42 );
```

end-of-command

```
print( 42 );
```

```
print(42);
```

```
print (42);
```

```
print ( 42 );
```

```
print ( 42 ) ;
```

```
print ( 4 2 );
```

```
print( 42 )
```

```
print[42];
```

```
PRINT( 42 );
```

EXERCISE

write a line of code that prints your favorite number

www.cs.dartmouth.edu/~fwp/exercise

Program Counter



```
1 print( 42 );  
2 print( 24 );
```

Program Counter



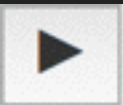
```
1 print( 42 );  
2 print( 24 );
```




```
1 print( 42 );  
2 print( 24 );
```

42
24

Program Counter



```
1 print( 42 );  
2 print( 24 );
```



42

Program Counter



```
1 print( 42 );  
2 print( 24 );
```



42
24

Program Counter



```
1 print( 42 );  
2 print( 24 );
```

42
24

Strings



```
1 print( "hello" );
```

```
print( "hello" );
```

```
print( "hello" );
```

command

```
print("hello");
```

parameter


```
print( "hello" );
```

end-of-command

```
print( "hello" );
```

```
print( 'hello' );
```

```
print("hello");
```

```
print( "hello' );
```

```
print ( hello );
```

```
print( "42" );
```

EXERCISE

write two lines of code that print

my favorite number is

1729

www.cs.dartmouth.edu/~fwp/exercise

numbers and strings – there are more data types

my favorite number is

1729

my favorite number is 1729

```
print( "my favorite number is " + 1729 );
```

```
print("my favorite number is " + 1729);
```

```
print("my favorite number is " + 1729 );
```



```
print( "my favorite number is " + 1729 );
```

concatenate (not add)

```
print( "my favorite number is" + 1729 );
```

```
print( 1 + 1729 );
```

```
print( 1 + 1729 );
```

addition

`print` is a command (function) that we provide

there are many more

and

we can define our own functions

Defining functions

```
var sayHello = function() {  
    print( "I say hello." );  
};
```

Defining functions

```
var sayHello = function() {  
    print( "I say hello." );  
};
```

Defining functions

```
var sayHello = function() {  
    print( "I say hello." );  
};
```


Defining functions

we are going to define something

```
var sayHello = function() {  
    print( "I say hello." );  
};
```

Defining functions

named sayHello

```
var sayHello = function() {  
    print( "I say hello." );  
};
```

Defining functions

which is a function

```
var sayHello = function() {  
    print( "I say hello." );  
};
```

Defining functions

```
var sayHello = function() {  
    print( "I say hello." );  
};
```

that evaluates this command

Defining functions



```
1 var sayHello = function() {  
2     print( "I say hello." );  
3 };
```

Defining functions



```
1 var sayHello = function() {  
2   print( "I say hello." );  
3 };
```

what happened?

Defining functions



```
1 var sayHello = function() {  
2   print( "I say hello." );  
3 };
```

we only **defined** a function

Evaluating functions



```
1 var sayHello = function() {  
2     print( "I say hello." );  
3 };  
4  
5 sayHello();
```


Evaluating functions



```
1 var sayHello = function() {  
2     print( "I say hello." );  
3 };  
4  
5 sayHello();
```

Evaluating functions



```
1 var sayHello = function() {  
2     print( "I say hello." );  
3 };  
4  
5 sayHello();
```

I say hello.

Defining functions

```
var <name> = function() {  
    <command 1>;  
    <command 2>;  
    <command 3>;  
};
```

Defining functions

```
var <name> = function() {  
    <command 1>;  
    <command 2>;  
    <command 3>;  
};
```

function header

Defining functions

```
var <name> = function() {
```

```
<command 1>;
```

```
<command 2>;
```

```
<command 3>;
```

```
};
```

function body

Defining functions

```
var <name> = function() {  
    <command 1>;  
    <command 2>;  
    <command 3>;  
};
```

style

Defining functions

```
var <name> = function() {  
    <command 1>;  
    <command 2>;  
    <command 3>;  
};
```

style

EXERCISE

write some Javascript code that prints


Hello, Hello

My name is Hany Farid

My favorite number is 1729

Goodbye, goodbye

www.cs.dartmouth.edu/~fwp/exercise/hellohello.html



```
1 var myFavoriteNumber = function() {  
2     print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6     print("My name is Hany Farid");  
7 };
```


Program Counter



```
1 var myFavoriteNumber = function() {  
2     print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6     print("My name is Hany Farid");  
7 };  
8  
9 print( "Hello, Hello" );  
10 introduce();  
11 myFavoriteNumber();  
12 print( "Goodbye, Goodbye" );|
```

Program Counter



```
1 var myFavoriteNumber = function() {  
2   print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6   print("My name is Hany Farid");  
7 };  
8  
9 print( "Hello, Hello" );  
10 introduce();  
11 myFavoriteNumber();  
12 print( "Goodbye, Goodbye" );|
```



Hello, Hello

Program Counter



```
1 var myFavoriteNumber = function() {  
2   print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6   print("My name is Hany Farid");  
7 };  
8  
9 print( "Hello, Hello" );  
10 introduce();  
11 myFavoriteNumber();  
12 print( "Goodbye, Goodbye" );|
```



Hello, Hello

Program Counter



```
1 var myFavoriteNumber = function() {  
2   print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6   print("My name is Hany Farid");  
7 };  
8  
9 print( "Hello, Hello" );  
10 introduce();  
11 myFavoriteNumber();  
12 print( "Goodbye, Goodbye" );|
```



Hello, Hello
My name is Hany Farid

Program Counter



```
1 var myFavoriteNumber = function() {  
2     print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6     print("My name is Hany Farid");  
7 };  
8  
9 print( "Hello, Hello" );  
10 introduce();  
11 myFavoriteNumber();  
12 print( "Goodbye, Goodbye" );|
```



Hello, Hello
My name is Hany Farid

Program Counter



```
1 var myFavoriteNumber = function() {  
2   print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6   print("My name is Hany Farid");  
7 };  
8  
9 print( "Hello, Hello" );  
10 introduce();  
11 myFavoriteNumber();  
12 print( "Goodbye, Goodbye" );|
```



Hello, Hello
My name is Hany Farid

Program Counter



```
1 var myFavoriteNumber = function() {  
2   print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6   print("My name is Hany Farid");  
7 };  
8  
9 print( "Hello, Hello" );  
10 introduce();  
11 myFavoriteNumber();  
12 print( "Goodbye, Goodbye" );|
```



Hello, Hello
My name is Hany Farid
My favorite number is 1729

Program Counter



```
1 var myFavoriteNumber = function() {  
2     print("My favorite number is " + 1729 );  
3 };  
4  
5 var introduce = function() {  
6     print("My name is Hany Farid");  
7 };  
8  
9 print( "Hello, Hello" );  
10 introduce();  
11 myFavoriteNumber();  
12 print( "Goodbye, Goodbye" );|
```



Hello, Hello
My name is Hany Farid
My favorite number is 1729
Goodbye, Goodbye

Functions and abstractions



1

```
showTime();
```

Functions and abstractions



```
1 showTime();
```



From “<https://tuck-course-devinbalkcom.c9users.io>”:

9:26:39 AM EDT

OK

Function parameters



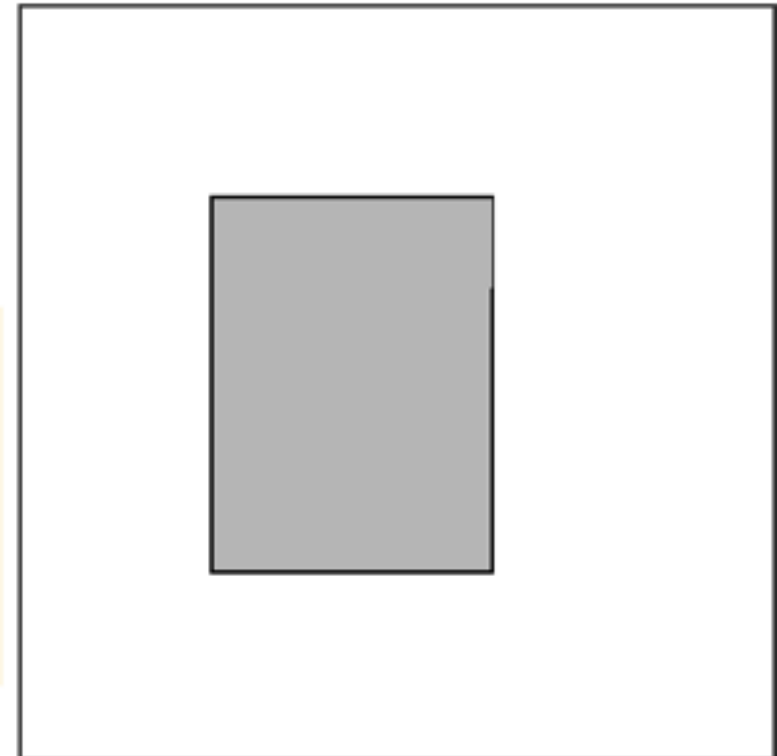
```
1 print( 42 );
```

Function parameters



```
1 rect(50, 50, 75, 100);
```

```
2
```



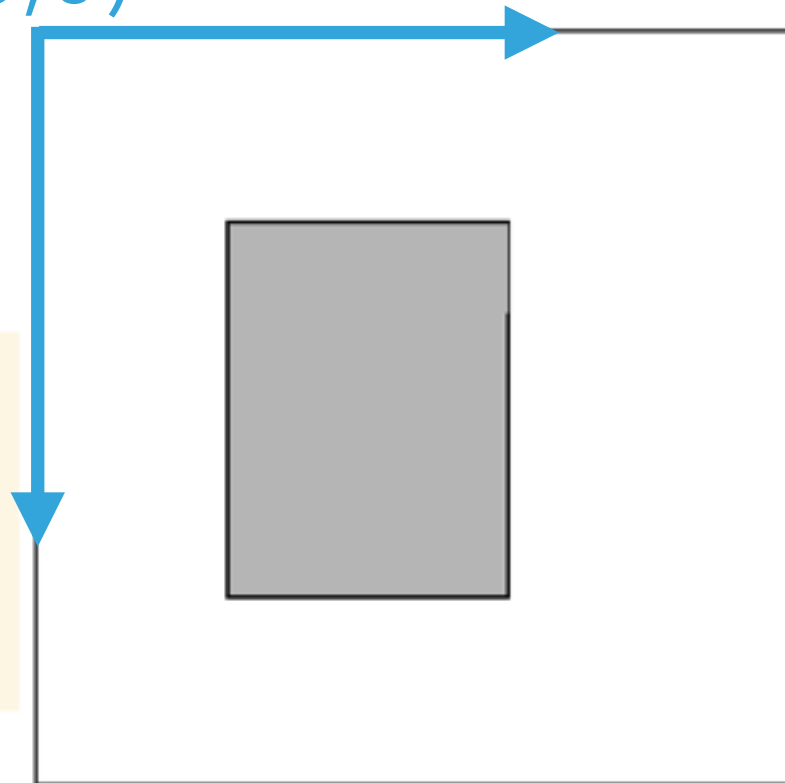
Function parameters



```
1 rect(50, 50, 75, 100);
```

```
2
```

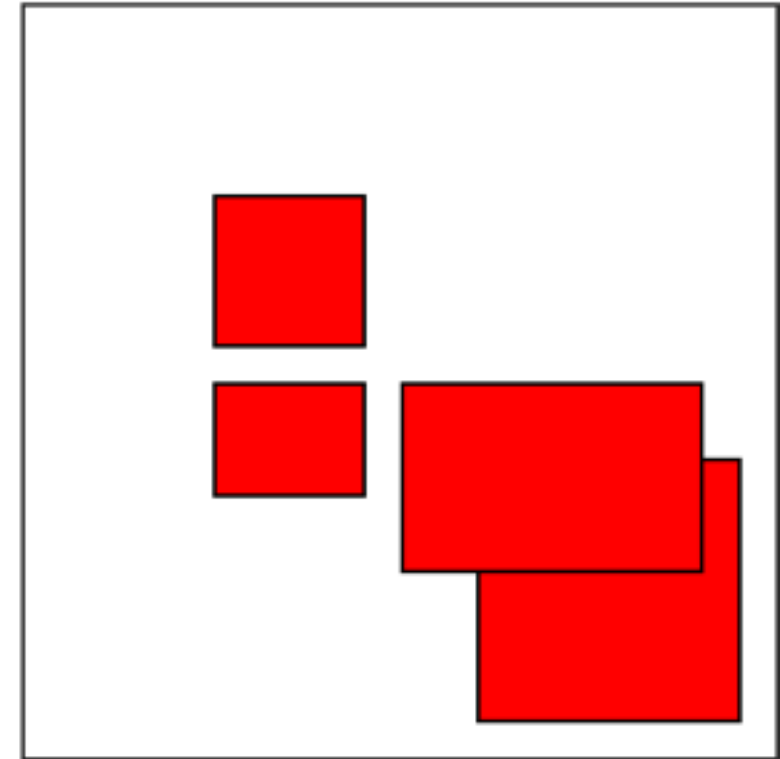
(0,0)



Function parameters



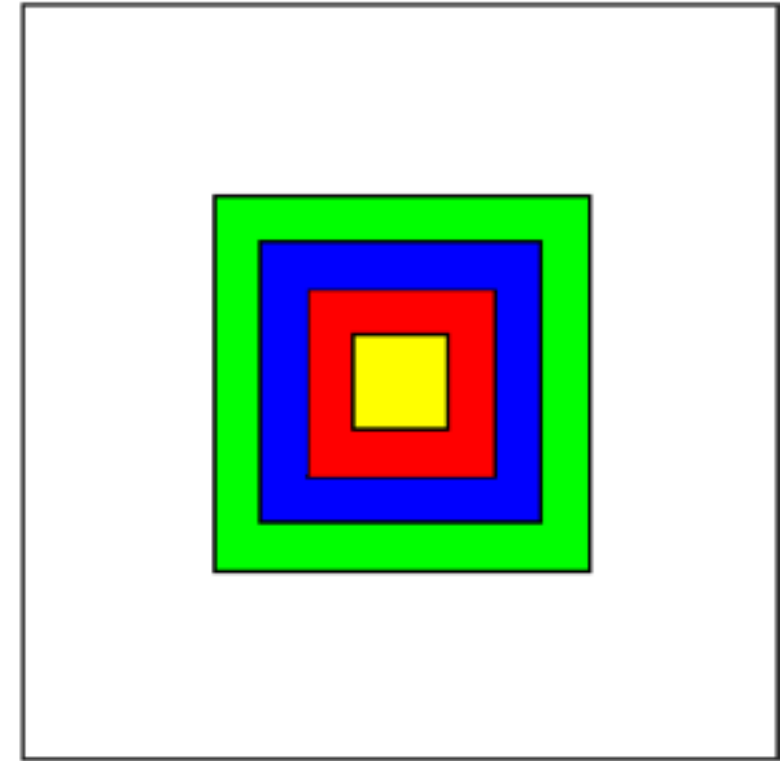
```
1 fill(255, 0, 0);  
2  
3 rect(50, 50, 40, 40);  
4 rect(50, 100, 40, 30);  
5 rect(120, 120, 70, 70);  
6 rect(100, 100, 80, 50);
```



Function parameters



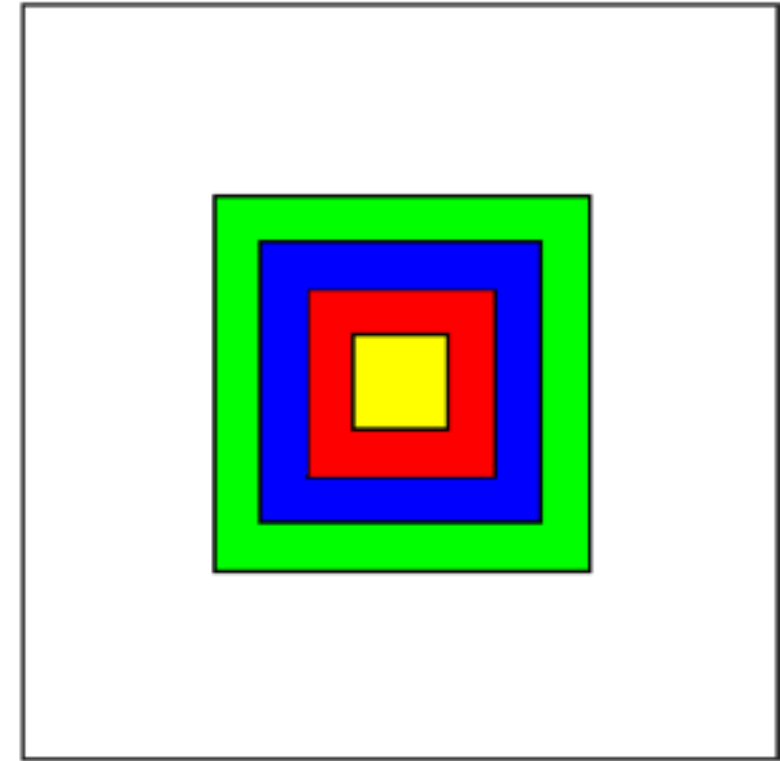
1
2
3
4
5
6
7
8
9
10
11



Function parameters



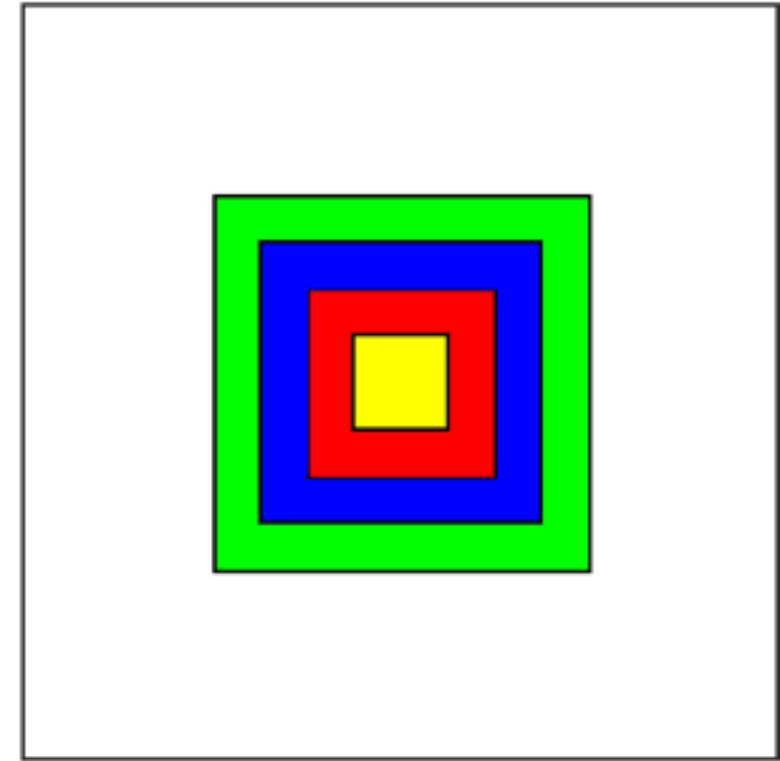
```
1 fill(0, 255, 0);  
2 rect(50, 50, 100, 100);  
3  
4  
5  
6  
7  
8  
9  
10  
11
```



Function parameters



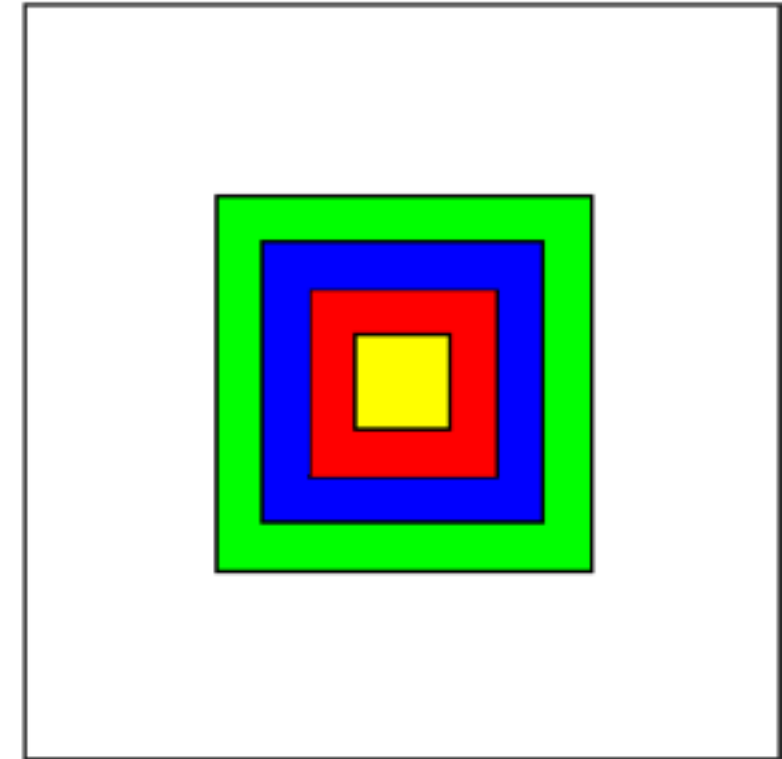
```
1 fill(0, 255, 0);  
2 rect(50, 50, 100, 100);  
3  
4 fill(0, 0, 255);  
5 rect(62, 62, 75, 75);  
6  
7  
8  
9  
10  
11
```



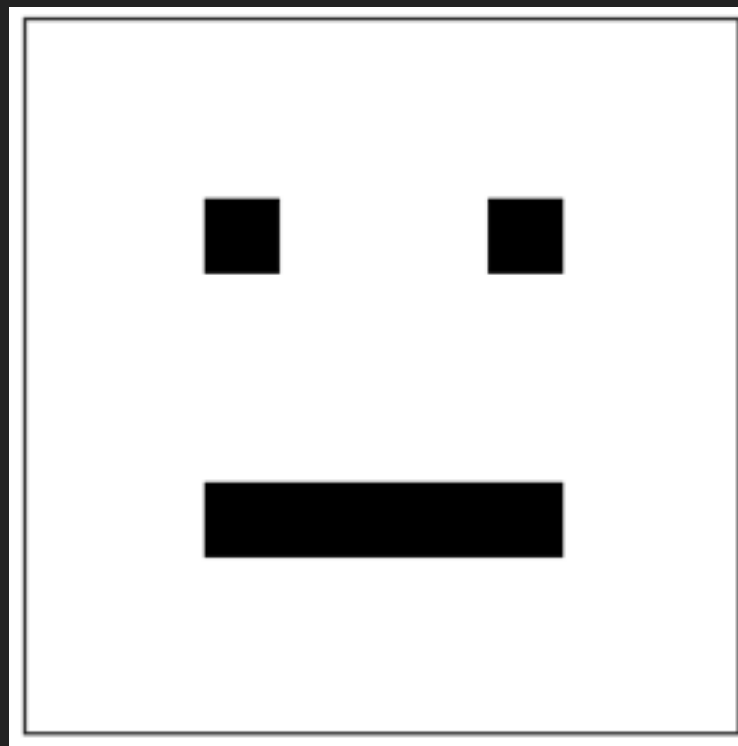
Function parameters



```
1 fill(0, 255, 0);  
2 rect(50, 50, 100, 100);  
3  
4 fill(0, 0, 255);  
5 rect(62, 62, 75, 75);  
6  
7 fill(255, 0, 0);  
8 rect(75, 75, 50, 50);  
9  
10 fill(255, 255, 0);  
11 rect(87, 87, 25, 25);
```



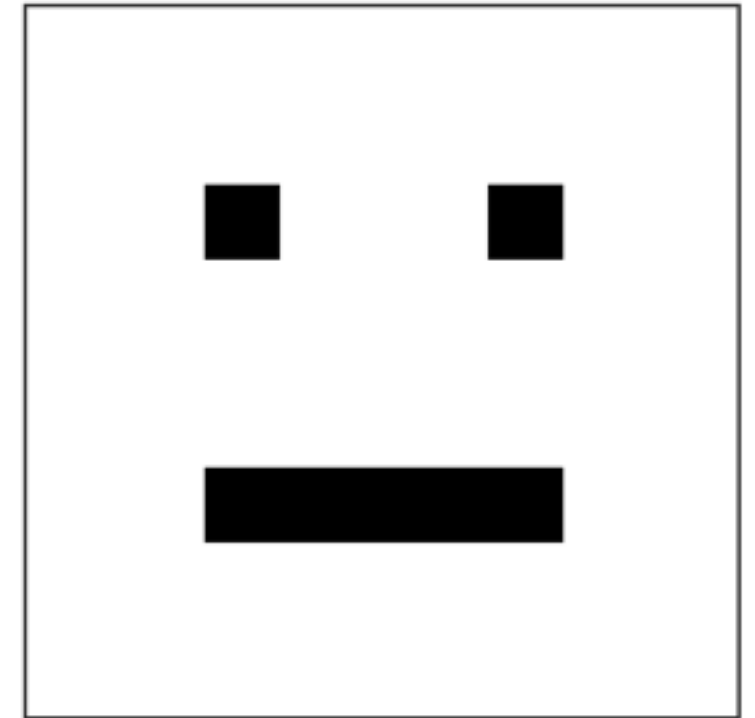
write some Javascript code that draws



www.cs.dartmouth.edu/~fwp/exercise

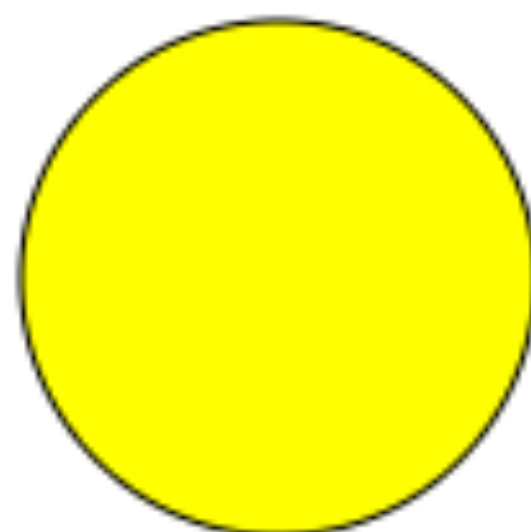


```
1 fill(0, 0, 0);  
2 rect(50, 50, 20, 20);  
3 rect(130, 50, 20, 20);  
4 rect(50, 130, 100, 20);  
5
```





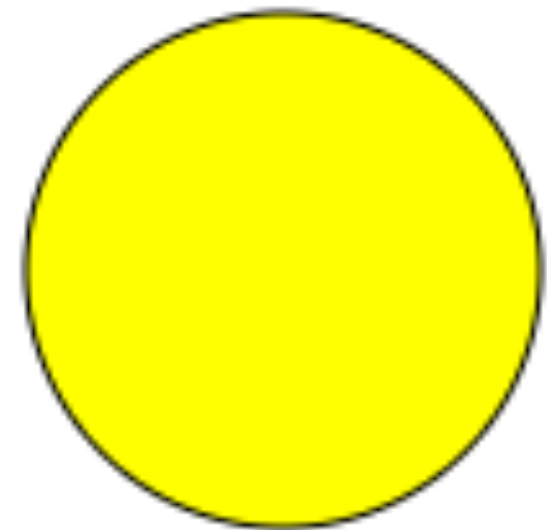
```
1 // draw the outline of the face
2 fill(255,255,0);
3 ellipse(100,100,100,100);
4 |
```





```
1 // draw the outline of the face
2 fill(255,255,0);
3 ellipse(100,100,100,100);
4 |
```

center

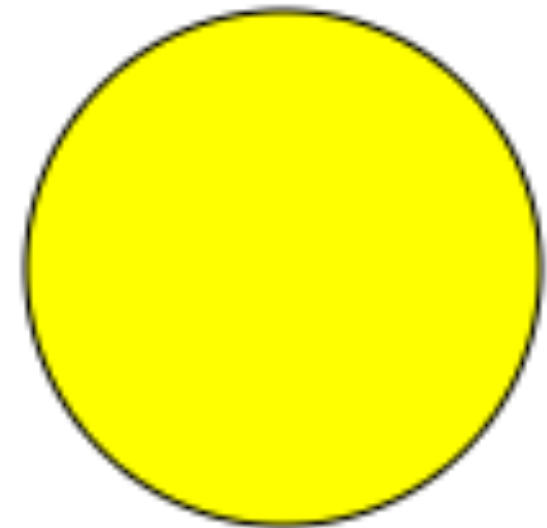




```
1 // draw the outline of the face  
2 fill(255,255,0);  
3 ellipse(100,100,100,100);
```

```
4 |
```

width/height





```
1 // draw the outline of the face
2 fill(255,255,0);
3 ellipse(100,100,100,100);
4
5 // draw the eyes
6 fill(0,0,0);
7 ellipse(80,90,10,10);
8 ellipse(120,90,10,10);
9 |
```





```
1 // draw the outline of the face
2 fill(255,255,0);
3 ellipse(100,100,100,100);
4
5 // draw the eyes
6 fill(0,0,0);
7 ellipse(80,90,10,10);
8 ellipse(120,90,10,10);
9
10 // draw the mouth
11 fill(255,255,0);
12 arc(100,110,50,40,0,PI);|
```





```
1 // draw the outline of the face
2 fill(255,255,0);
3 ellipse(100,100,100,100);
4
5 // draw the eyes
6 fill(0,0,0);
7 ellipse(80,90,10,10);
8 ellipse(120,90,10,10);
9
10 // draw the mouth
11 fill(255,255,0);
12 arc(100,110,50,40,0,PI);|
```

center





```
1 // draw the outline of the face
2 fill(255,255,0);
3 ellipse(100,100,100,100);
4
5 // draw the eyes
6 fill(0,0,0);
7 ellipse(80,90,10,10);
8 ellipse(120,90,10,10);
9
10 // draw the mouth
11 fill(255,255,0);
12 arc(100,110,50,40,0,PI);|
```

width/height





```
1 // draw the outline of the face
2 fill(255,255,0);
3 ellipse(100,100,100,100);
4
5 // draw the eyes
6 fill(0,0,0);
7 ellipse(80,90,10,10);
8 ellipse(120,90,10,10);
9
10 // draw the mouth
11 fill(255,255,0);
12 arc(100,110,50,40,0,PI);|
```

start/stop



write some Javascript code that draws a smiley face: write three functions to draw eyes, mouth, face outline



www.cs.dartmouth.edu/~fwp/exercise



```
1 // draw the outline of the face
2 var faceOutline= function() {
3     fill(255,255,0);
4     ellipse(100,100,100,100);
5 }
6
7 // draw the eyes
8 var eyes = function() {
9     fill(0,0,0);
10    ellipse(80,90,10,10);
11    ellipse(120,90,10,10);
12 }
13
14 // draw the mouth
15 var mouth = function() {
16     fill(255,255,0);
17     arc(100,110,50,40,0,PI);
18 }
19
20 faceOutline();
21 eyes();
22 mouth();
```




```
1 // draw the outline of the face
2 var faceOutline= function() {
3     fill(255,255,0);
4     ellipse(100,100,100,100);
5 }
6
7 // draw the eyes
8 var eyes = function() {
9     fill(0,0,0);
10    ellipse(80,90,10,10);
11    ellipse(120,90,10,10);
12 }
13
14 // draw the mouth
15 var mouth = function() {
16     fill(255,255,0);
17     arc(100,110,50,40,0,PI);
18 }
19
20 faceOutline();
21 eyes();
22 mouth();
```

what happens if I
want to scale or
move the face?

I need to manually
and consistently
change all of these
variables

Can we do better?