MIT-IIT Robotics Program

Logic Flow – Booleans, Logical & Relational Operators, Conditionals, While Loops

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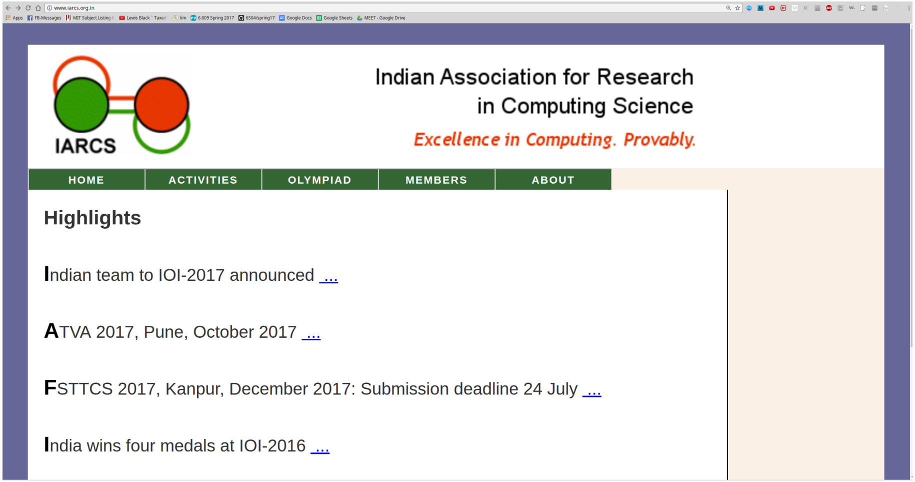
June 5, 2017

Outline

'

IARCS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Highlights

Indian team to IOI-2017 announced ...

ATVA 2017, Pune, October 2017 ...

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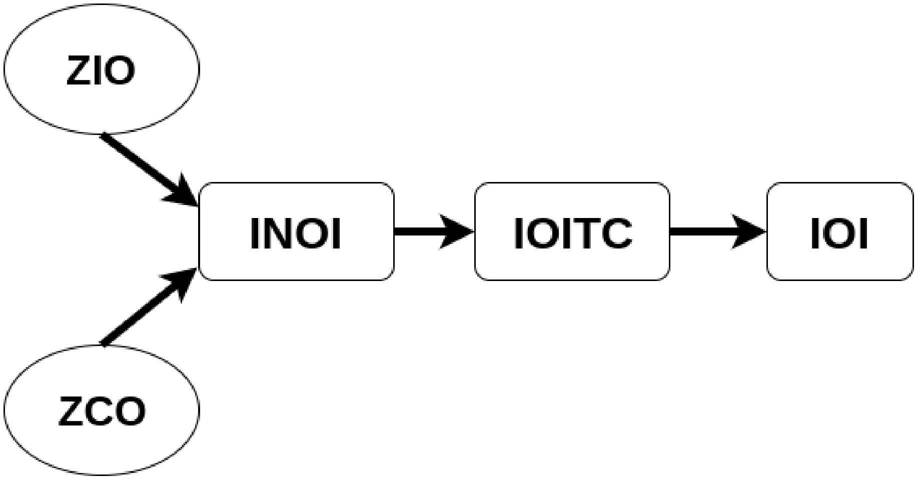
India wins four medals at IOI-2016 ...

Levels



Outline

Installing

```
fill(0); //Set fill color
ellipse(a, b, c, d);
```

```
fill(0); //Set fill color
ellipse(a, b, c, d);
```

a	float: x-coordinate of ellipse
b	float: y-coordinate of ellipse
c	float: width of the ellipse
d	float: height of the ellipse

Window Size

```
int displayWidth = 800;
int displayHeight = 400;
```

Window Size

```
int displayWidth = 800;
int displayHeight = 400;
size(displayWidth, displayHeight);
```

Window Size

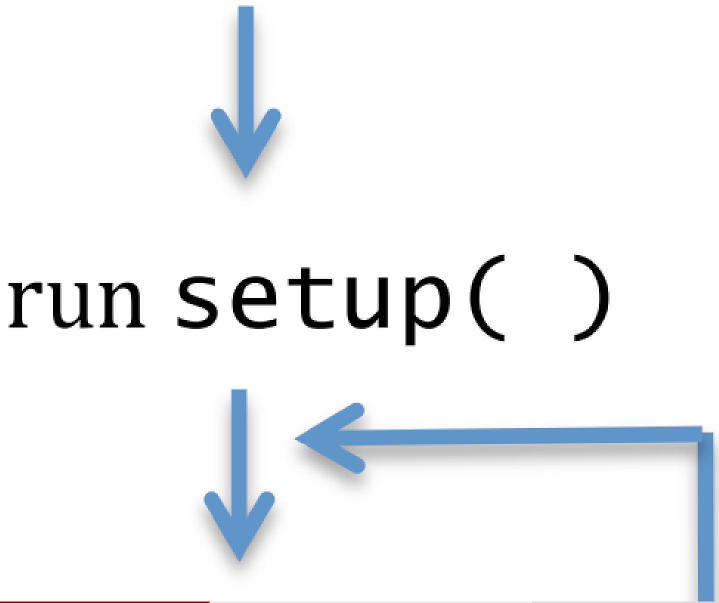
```
int displayWidth = 800;
int displayHeight = 400;
size(displayWidth, displayHeight);
// The wrong way to specify
// the middle of the screen
ellipse(400, 200, 50, 50);
```

Window Size

```
int displayWidth = 800;
int displayHeight = 400;

size(displayWidth, displayHeight);

// The wrong way to specify
// the middle of the screen
ellipse(400, 200, 50, 50);

// Always the middle
// no matter how size() changes
ellipse(width/2, height/2, 50, 50);
```

Outline

Flow



Setup and Loop

```
int displayWidth = 800;
int displayHeight = 400;
```

Setup and Loop

```
int displayWidth = 800;
int displayHeight = 400;

void setup (){
    size(displayWidth, displayHeight);
}
```

Setup and Loop

```
int displayWidth = 800;
int displayHeight = 400;

void setup (){
    size(displayWidth, displayHeight);
}

void draw (){
    background(255);
    fill(0);
    ellipse(width/2, height/2, 50, 50);
}
```

Outline

What is a Function ?

A reusable block of code that performs a task.

What is a Function ?

A reusable block of code that performs a task.

- written by you and used by someone else
- written by someone else and used by you

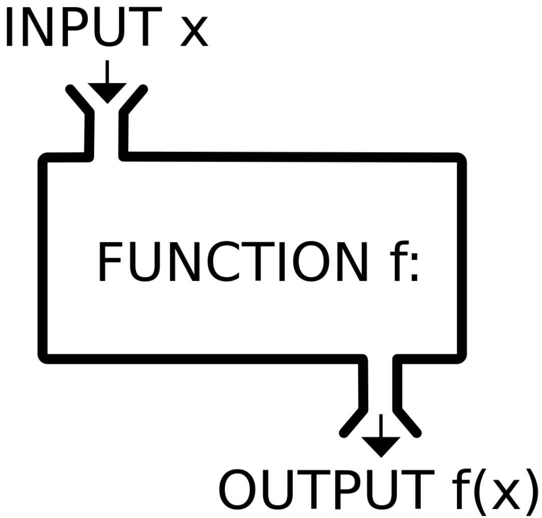
What is a Function ?

A reusable block of code that performs a task.

- written by you and used by someone else
- written by someone else and used by you

Don't need to know what the code looks like !

What is a Function ?



Outline

You have already seen some functions.

- main()
- sqrt(81)
- setup()
- draw()
- ellipse(50. 60, 10, 10)
- fill(255)

The ellipse function.

Inputs to the ellipse() function

Coordinates of center. Size of ellipse.

The ellipse function.

Inputs to the ellipse() function

Coordinates of center. Size of ellipse.

What does the ellipse() function do ?

The ellipse function.

Inputs to the ellipse() function

Coordinates of center. Size of ellipse.

What does the ellipse() function do ?

Draws an ellipse on the screen, with specified parameters.

The ellipse function.

Inputs to the ellipse() function

Coordinates of center. Size of ellipse.

What does the ellipse() function do ?

Draws an ellipse on the screen, with specified parameters.

How ?

The ellipse function.

Inputs to the ellipse() function

Coordinates of center. Size of ellipse.

What does the ellipse() function do ?

Draws an ellipse on the screen, with specified parameters.

How ?

Who cares ? . . .

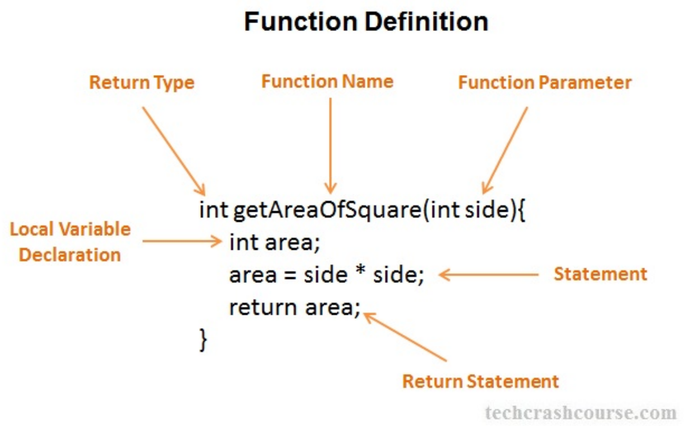
What do all functions have in common ?

- main()
- sqrt(81)
- draw()
- ellipse(50, 60, 10, 10)
- fill(255)

Parentheses ()

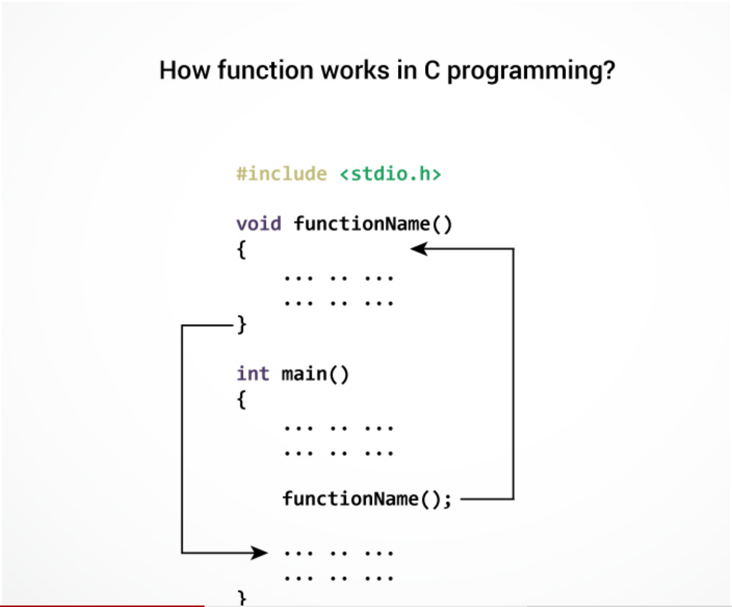
Outline

The structure of a Function



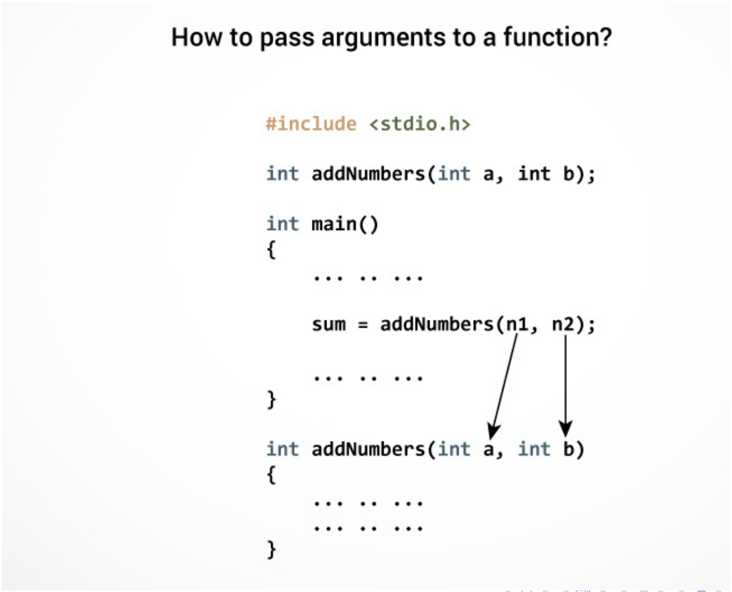
```
int getAreaOfSquare(int side){
    int area;
    area = side * side;
    return area;
}
```

Control Flow



```
#include <stdio.h>

void functionName()
{
    ... .. ...
    ... .. ...
}

int main()
{
    ... .. ...
    ... .. ...

    functionName();

    ... .. ...
    ... .. ...
}
```

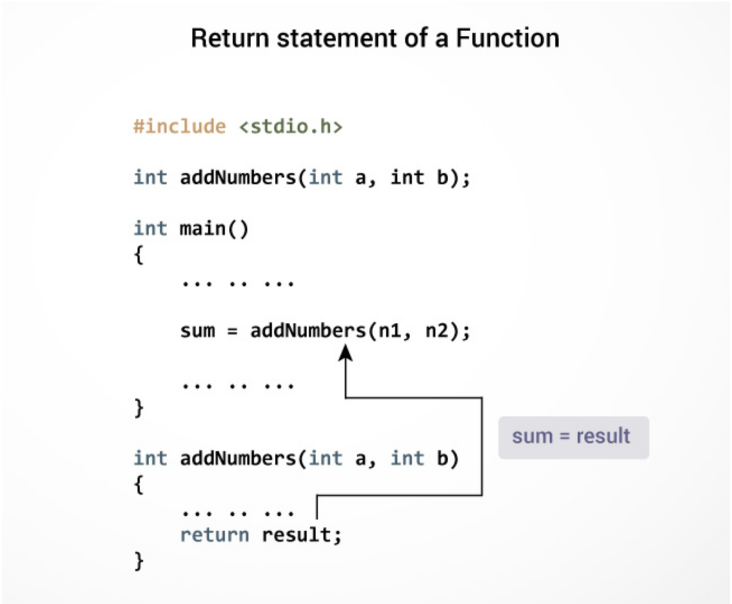
Input to a Function



How to pass arguments to a function?

```
#include <stdio.h>

int addNumbers(int a, int b);

int main()
{
    ... .. ...

    sum = addNumbers(n1, n2);

    ... .. ...
}

int addNumbers(int a, int b)
{
    ... .. ...
    ... .. ...
}
```

Return Value (output) of a Function


Return statement of a Function

```
#include <stdio.h>

int addNumbers(int a, int b);

int main()
{
    ... .. ...

    sum = addNumbers(n1, n2);

    ... .. ...
}

int addNumbers(int a, int b)
{
    ... .. ...
    return result;
}
```

Exercise

Write a function drawTarget(), that takes x and y coordinate as input, and displays a target (concentric black and white circles) in that location.

Modify this function to take one integer N as input, and draw a target with N circles. This means that drawTarget(5) should display a target with 5 concentric circles.

Use this code to test.

```
void draw () {
    if (mousePressed) {
        drawTarget(mouseX, mouseY);
        delay(200);
    }
}
```

Outline

Window Size

```
int width = 800;
int height = 400;
```

Window Size

```
int width = 800;
int height = 400;
size(width, height);
```

Window Size

```
int width = 800;
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// The wrong way to specify
// the middle of the screen
ellipse(400, 200, 50, 50);
```

Window Size

```
int width = 800;
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size(width, height);

// The wrong way to specify
// the middle of the screen
ellipse(400, 200, 50, 50);

// Always the middle
// no matter how size() changes
ellipse(width/2, height/2, 50, 50);
```

Rectangle

```
rect(a, b, c, d);
rect(a, b, c, d, r);
rect(a, b, c, d, tl, tr, br, bl);
```

Rectangle

```
rect(a, b, c, d);
rect(a, b, c, d, r);
rect(a, b, c, d, tl, tr, br, bl);
```

a	float: x-coordinate of rectangle
b	float: y-coordinate of rectangle
c	float: width of the rectangle
d	float: height of the rectangle

Rectangle

```
rect(a, b, c, d);
rect(a, b, c, d, r);
rect(a, b, c, d, tl, tr, br, bl);
```

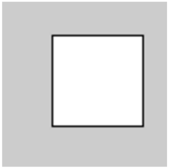
a	float: x-coordinate of rectangle
b	float: y-coordinate of rectangle
c	float: width of the rectangle
d	float: height of the rectangle
r	float: radii for all four corners

Rectangle

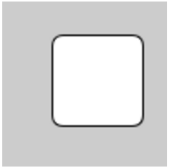
```
rect(a, b, c, d);
rect(a, b, c, d, r);
rect(a, b, c, d, tl, tr, br, bl);
```

a	float: x-coordinate of rectangle
b	float: y-coordinate of rectangle
c	float: width of the rectangle
d	float: height of the rectangle
r	float: radii for all four corners
tl	float: radius of top-left corner
tr	float: radius of top-right corner
br	float: radius of bottom-right corner
bl	float: radius of bottom-left corner

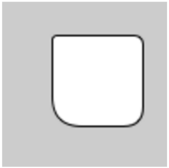
rect() Examples



```
rect(30, 20, 55, 55);
```



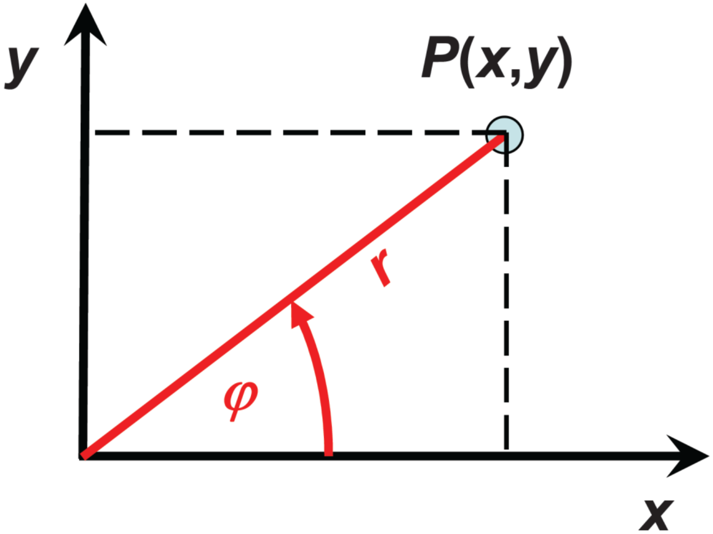
```
rect(30, 20, 55, 55, 7);
```



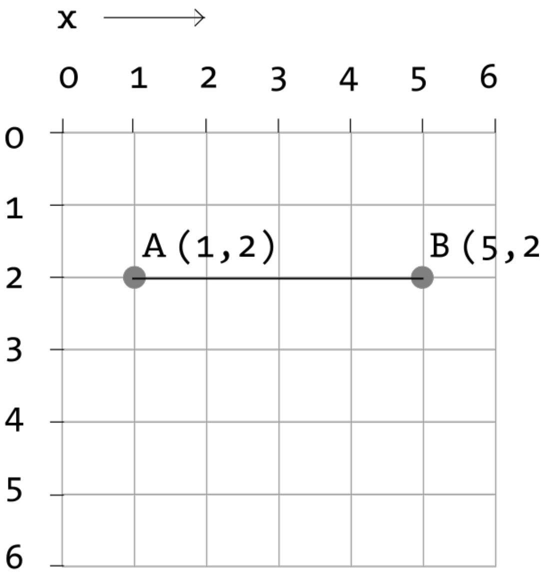
```
rect(30, 20, 55, 55, 3, 6, 12, 18);
```

Outline

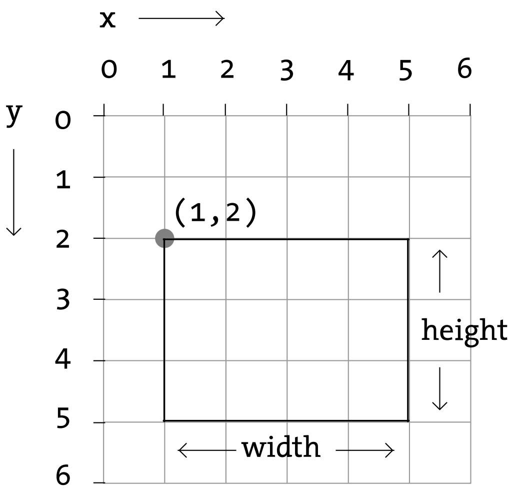
Normal Coordinate System



Processing Coordinate System



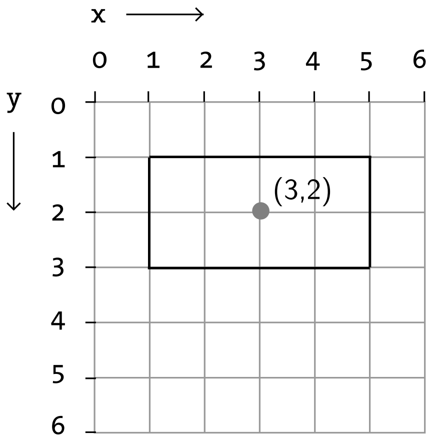
Drawing a Rectangle



rect(x , y , width , height) ;

Example: `rect (1,2,4,3) ;`

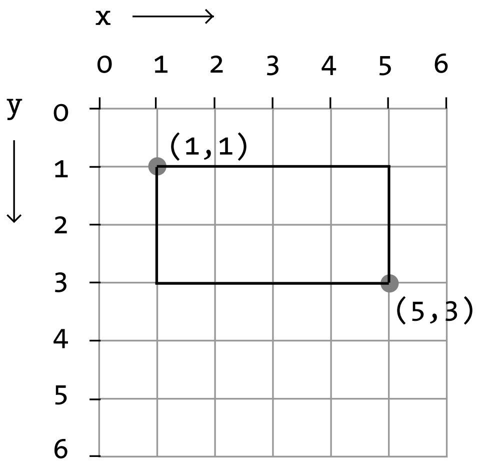
CENTER Rectangle



```
rectMode ( CENTER ) ;
rect( x , y , width , height ) ;
```

Example:
```
rectMode ( CENTER ) ;
rect ( 3 , 2 , 4 , 2 ) ;
```

CORNERS Rectangle



```
rectMode(CORNERS);
rect(x1,y1,x2,y2);
```

Example:
```
rectMode(CORNERS);
rect(1,1,5,3);
```

Outline

Print Statements

- print() statement prints all items separated by spaces

```
print(item1, item2, . . . );
```

Print Statements

- print() statement prints all items separated by spaces

```
print(item1, item2, . . . );
```

- println() is the same, but prints a new line at the end

```
println(item1, item2, . . . );
```

Outline

Mouse Handling

- Mouse position – Global Variables

```
    mouseX, mouseY
    ellipse(mouseX, mouseY, 2*R, 2*R)
```

Mouse Handling

- Mouse position – Global Variables

```
mouseX, mouseY
ellipse(mouseX, mouseY, 2*R, 2*R)
```

- Detect Mouse Click

```
if (mousePressed) {
   fill(255); // White
} else {
    fill(0); // Black
}
```

Keyboard Handling

```
char LEFT = 'a', RIGHT = 'd', UP = 'w';
boolean left, right, up;
```

Keyboard Handling

```
char LEFT = 'a', RIGHT = 'd', UP = 'w';
boolean left, right, up;
void keyPressed() {
    if (key == LEFT)        left = true;
    if (key == RIGHT)       right = true;
    if (key == UP)          up = true;
}
```

Keyboard Handling

```
char LEFT = 'a', RIGHT = 'd', UP = 'w';
boolean left, right, up;
void keyPressed() {
    if (key == LEFT)        left = true;
    if (key == RIGHT)       right = true;
    if (key == UP)          up = true;
}
void keyReleased() {
    if (key == LEFT)        left = false;
    if (key == RIGHT)       right = false;
    if (key == UP)          up = false;
}
```

Keyboard Handling

```
if (left) {
    // Move Left . . .
}
if (right) {
    // Move Right . . .
}
if (up) {
    // Move Up . . .
}
```

Outline

Define Position and Velocity

```
float ballX = width/2, ballY = height/2;
float ballVx = 2, ballVy = 3;
```

Define Position and Velocity

```
float ballX = width/2, ballY = height/2;
float ballVx = 2, ballVy = 3;

void draw() {
    ellipse(ballX, ballY, 2*R, 2*R);
    updateBallPosition();
}
```

Define Position and Velocity

```
float ballX = width/2, ballY = height/2;
float ballVx = 2, ballVy = 3;
void draw() {
    ellipse(ballX, ballY, 2*R, 2*R);
    updateBallPosition();
}
void updateBallPosition() {
    ballX += ballVx;
    ballY += ballVy;
}
```

Gravity

```
float gravity = 1;
```

Gravity

```
float gravity = 1;
void draw() {
    ellipse(ballX, ballY, 2*R, 2*R);
    updateBallVelocity();
    updateBallPosition();
}
```

Gravity

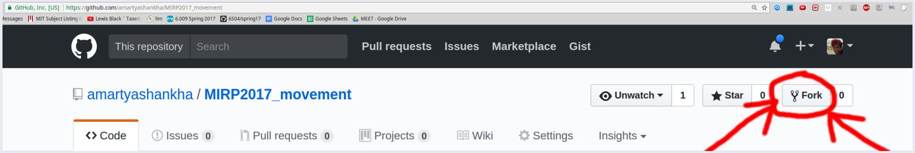
```
float gravity = 1;
void draw() {
    ellipse(ballX, ballY, 2*R, 2*R);
    updateBallVelocity();
    updateBallPosition();
}
void updateBallVelocity() {
    ballVy += gravity;
}
```

Outline

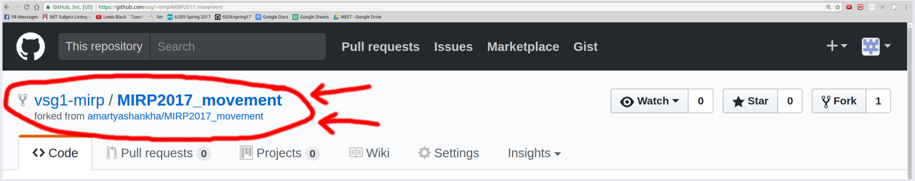
Forking

Go to https://github.com/amartyashankha/MIRP2017_movement

Click on Fork

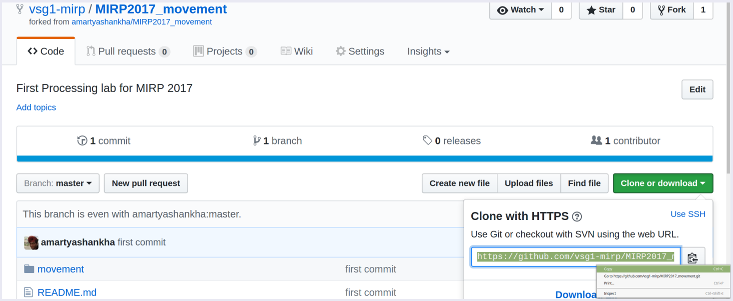


The title should change



Cloning

Clone the repo


vsg1-mirp / **MIRP2017_movement**
forked from amartyashankha/MIRP2017_movement

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First Processing lab for MIRP 2017
Add topics

Edit

1 commit | **1** branch | **0** releases | **1** contributor

Branch: **master** | **New pull request** | **Create new file** | **Upload files** | **Find file** | **Clone or download**

This branch is even with amartyashankha:master.

amartyashankha first commit

movement	first commit
README.md	first commit

Clone with HTTPS Use SSH
Use Git or checkout with SVN using the web URL.

```
https://github.com/vsg1-mirp/MIRP2017_r
```

Copy Ctrl+C
Go to https://github.com/vsg1-mirp/MIRP2017_movement.git
Print... Ctrl+P
Inspect Ctrl+Shift+I

Downloa

- Open Processing
- File $\rightarrow$ Open
- Navigate to the files inside Movement

Exercise

Resolve collisions with other walls. Move ball using WASD.

Move ball using WASD.