

MIT-IIT Robotics Program

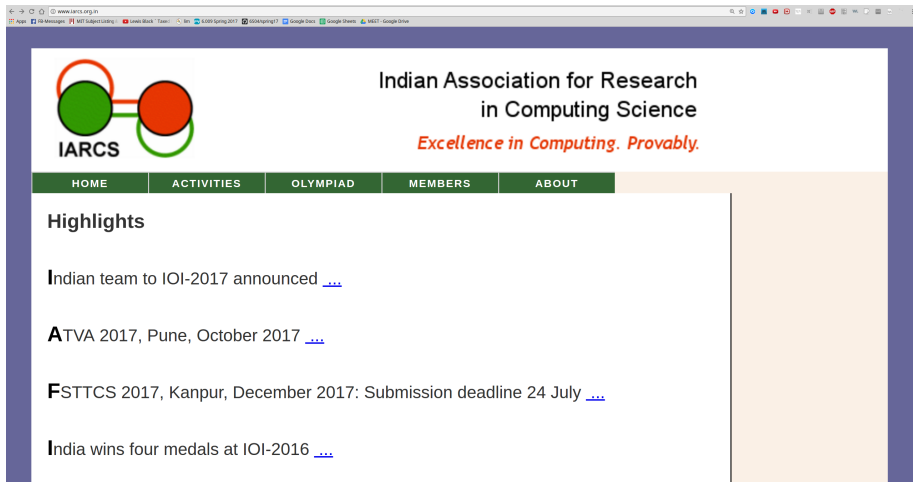
Logic Flow – Booleans, Logical & Relational Operators, Conditionals, While Loops

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June 5, 2017

Outline

- 1 Indian Computing Olympiad
- 2 Processing Graphics
 - Getting Started
 - Logic Flow
- 3 Functions
 - Definition
 - Examples
 - Defining Functions
- 4 More on Processing
 - Primitives
 - Coordinate System
 - Debugging
 - Interaction
 - Physics
 - Exercise



The screenshot shows a web browser window displaying the IARCS website. The browser's address bar shows 'www.iarcs.org.in'. The website has a purple header with the IARCS logo on the left, which consists of two overlapping circles, one green and one red, with the text 'IARCS' below them. To the right of the logo, the text 'Indian Association for Research in Computing Science' is displayed in black, followed by the tagline 'Excellence in Computing. Provably.' in red. Below the header is a navigation bar with five green buttons labeled 'HOME', 'ACTIVITIES', 'OLYMPIAD', 'MEMBERS', and 'ABOUT'. The main content area has a white background and a large orange sidebar on the right. The 'Highlights' section on the left lists four items: 'Indian team to IOI-2017 announced', 'ATVA 2017, Pune, October 2017', 'FSTTCS 2017, Kanpur, December 2017: Submission deadline 24 July', and 'India wins four medals at IOI-2016'. Each item has a blue link icon to its right. The browser's taskbar at the bottom shows several open applications, including a message client, a web browser, and a file explorer.

www.iarcs.org.in

Indian Association for Research
in Computing Science

Excellence in Computing. Provably.

HOME ACTIVITIES OLYMPIAD MEMBERS ABOUT

Highlights

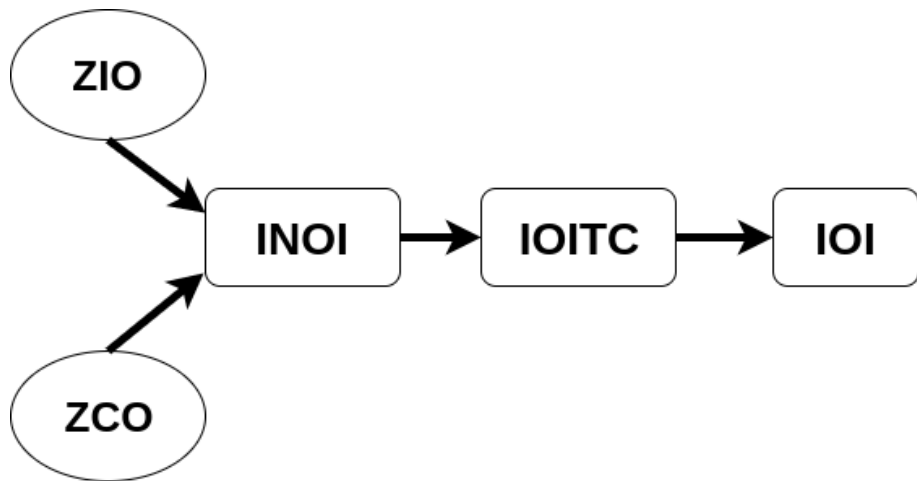
Indian team to IOI-2017 announced [...](#)

ATVA 2017, Pune, October 2017 [...](#)

FSTTCS 2017, Kanpur, December 2017: Submission deadline 24 July [...](#)

India wins four medals at IOI-2016 [...](#)

Levels



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Installing

```
tar -xvzf processing.tar.gz  
cd processing  
./processing
```

Ellipse

```
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

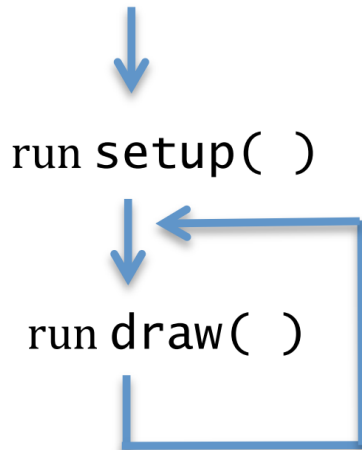
```
int displayWidth = 800;
int displayHeight = 400;
size(displayWidth, displayHeight);

// 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);
```

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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);
}
```

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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

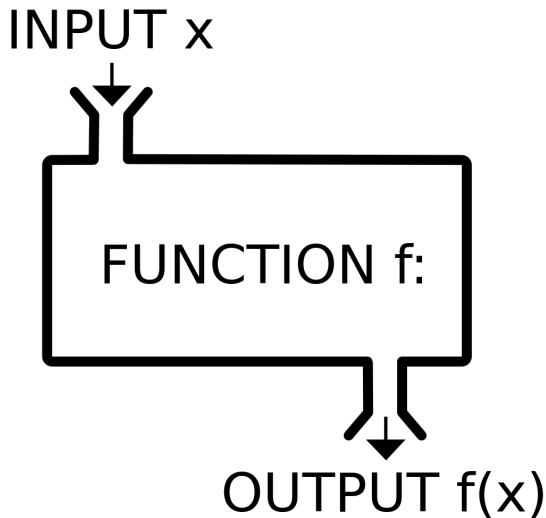
What is a Function ?

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 ?



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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)`

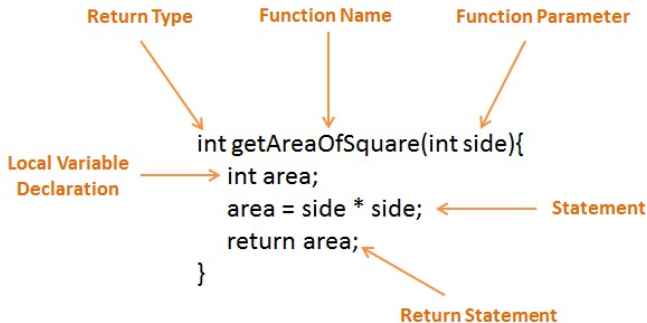
Parentheses ()

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The structure of a Function

Function Definition



techcrashcourse.com

How function works in C programming?

```
#include <stdio.h>

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

int main()
{
    ... ..
    ... ..
    functionName();
    ... ..
    ... ..
}
```

The diagram illustrates the control flow between a function and its caller. A call to `functionName()` inside the `main()` function's body is shown. An arrow originates from this call, goes up and to the right, and then turns left to point at the opening curly brace of the `functionName()` function definition. Another arrow originates from the closing curly brace of the `functionName()` definition, goes up and to the left, and then turns down to point at the line of code immediately following the `functionName();` call in the `main()` function. This visualizes the transfer of control from the caller to the function and back upon completion.

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)
{
    ... ..
    ... ..
}
```



The diagram illustrates the flow of arguments. Two arrows originate from the parameters `n1` and `n2` in the function call `addNumbers(n1, n2);` within the `main` function. These arrows point downwards to the parameters `a` and `b` in the function definition `int addNumbers(int a, int b)`, indicating that the values of `n1` and `n2` are passed to `a` and `b` respectively.

Return Value (output) of a Function

Return statement of a Function

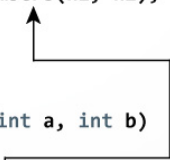
```
#include <stdio.h>

int addNumbers(int a, int b);

int main()
{
    ... ..
    sum = addNumbers(n1, n2);
    ... ..
}

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

sum = result

A diagram consisting of two lines forming a U-shape. The bottom line starts from the 'return result;' statement in the addNumbers function and extends to the right. From there, a vertical line goes up, and then a horizontal line extends to the left, ending with an arrow pointing to the 'sum = addNumbers(n1, n2);' statement in the main function.

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);  
    }  
}
```

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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;  
int height = 400;  
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);
```

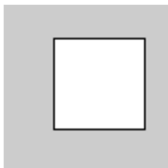
a float: x-coordinate of rectangle
b float: y-coordinate of rectangle
c float: width of the rectangle
d float: height of the rectangle
r float: radii for all four corners

Rectangle

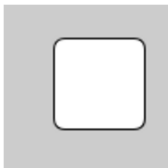
```
rect(a, b, c, d);  
rect(a, b, c, d, r);  
rect(a, b, c, d, tl, tr, br, bl);
```

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

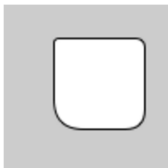
rect() Examples



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



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

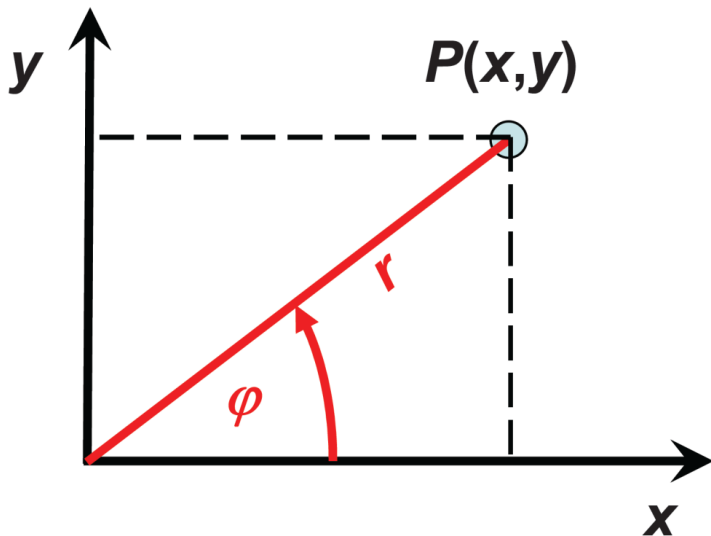


```
rect(30, 20, 55, 55, 3, 6, 12, 18);
```

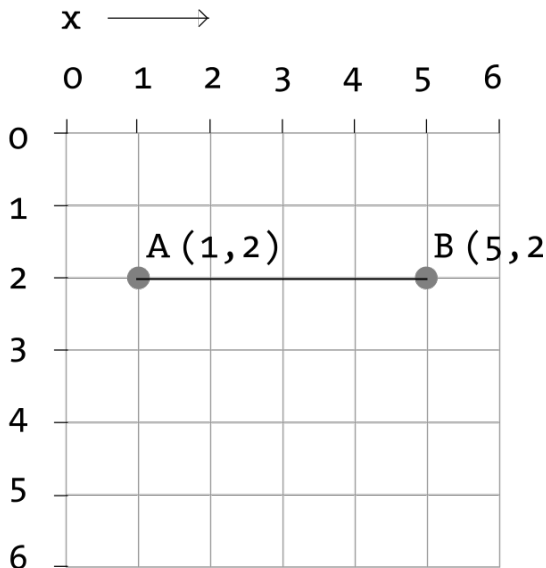
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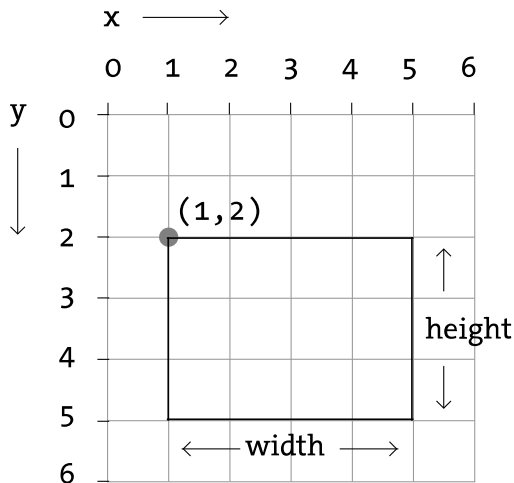
Normal Coordinate System



Processing Coordinate System



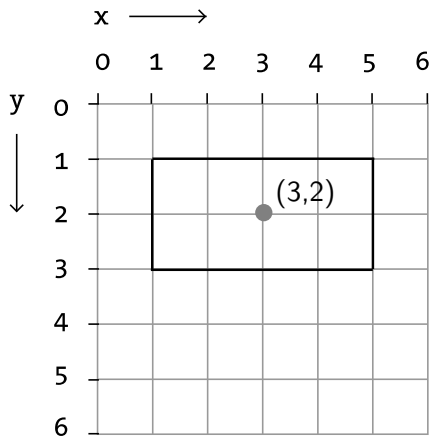
Drawing a Rectangle



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

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

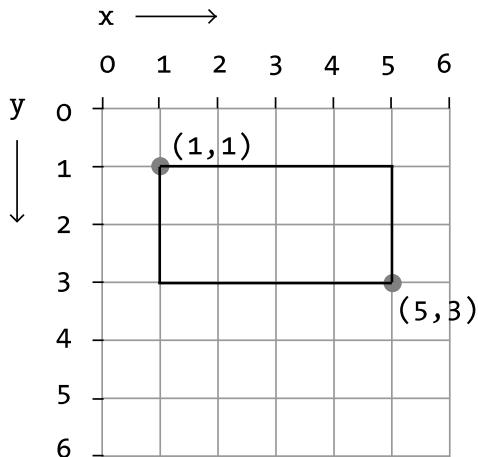
CENTER Rectangle



```
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) ;`

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- `print()` statement prints all items separated by spaces

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

- `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, . . . );
```

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- 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 . . .  
}
```

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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;
}
```

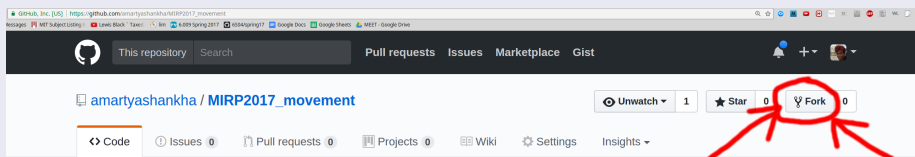
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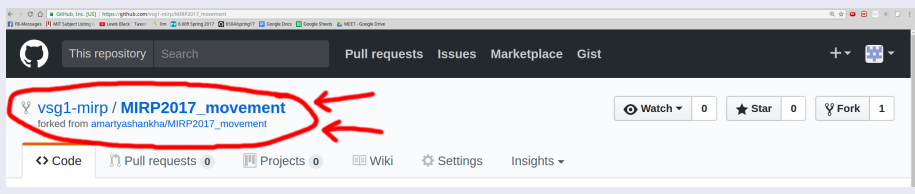
Forking

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

Click on Fork



The title should change



Cloning

Clone the repo

The screenshot shows the GitHub interface for the repository 'vsg1-mirp / MIRP2017_movement', which is forked from 'amartyashankha/MIRP2017_movement'. The repository has 0 Watchers, 0 Stars, and 1 Fork. The main content area displays the repository name and a description: 'First Processing lab for MIRP 2017'. Below this, it shows 1 commit, 1 branch, 0 releases, and 1 contributor. A file list includes 'movement' (first commit) and 'README.md' (first commit). A 'Clone or download' button is visible, which has opened a dropdown menu. The dropdown menu shows 'Clone with HTTPS' as the selected option, with a URL 'https://github.com/vsg1-mirp/MIRP2017_movement.git' and a 'Download' button. Other options in the dropdown include 'Use SSH', 'Use Git or checkout with SVN using the web URL.', and 'Download ZIP'.

- Open Processing
- File → Open
- Navigate to the files inside Movement

Exercise

Resolve collisions with other walls. Move ball using WASD.

Move ball using WASD.