Introduction to Turtle Graphics

Turtle graphics is a term in computer graphics which means drawing using a relative cursor (the "turtle") upon a coordinate system.

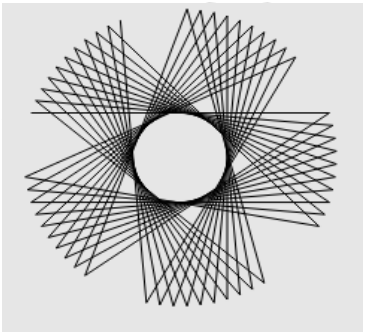
In the following, a pattern is drawn using the commands of Turtle graphics.

```
<script>
  var t_x = 0;
  var t_y = 0;
  var t_angle = 0.0;
  var t_penIsDown = true;
  var t_color = 128;
  var t_weight = 1;

  function t_start(x, y) {
    t_x = x;
    t_y = y;
  }

  function t_left(d) {
    t_angle -= d;
  }

  function t_right(d) {
    t_angle += d;
  }

  ...

  function setup() {
    createCanvas(300, 300);
    background(230);
    t_start(50, 100);
    t_penDown();
    t_setColor(0);
    for (var i = 1; i <= 50; i++) {
      t_forward(200);
      t_right(145);
    }
  }
</script>
```

Implementation of Turtle Graphics Operations:

- The global variables are values managed by Turtle commands. We do not use them directly in our code.
- The functions are the commands which we can use. Below is a list of some commands:
  - t_start(x, y) -- make a turtle at x, y, default facing right
  - t_left(d) -- turn left by d degrees
  - t_right(d) -- turn right by d degrees
  - t_forward(p) -- move forward by p pixels
  - t_back(p) -- move back by p pixels
  - t_penDown() -- pen down
  - t_penUp() -- pen up
  - t_goto(x, y) -- go straight to this location
  - t_setColor(color) -- set the drawing color

[http://cmuems.com/2015c/deliverables/turtle-graphics/]



(Program A)

Download Program A. Try out the following to know more about Turtle Graphics

(a) In the `setup()` function, change the for-loop condition to each of the following. Observe the output.
   (i) `i<=1`
   (ii) `i<=2`
   (iii) `i<=100`

(b) Download and try program B -- It **animates** the sketching process. Observe how the pattern is created.

   Change the `draw()` method as follows. You may need to modify `setup()` to improve the frameRate and the starting point.

```
//Variation 1

function draw() {
  background(230, 5);
  t_forward(frameCount * 0.5);
  t_right(215);
}
```

```
//Variation 2

function draw() {
  background(230, 2);
  t_forward(frameCount*0.1);
  t_right(10);
}
```

Questions for Review and Preparation of Exam

* In addition to the following, please also review the learned topics covered in the semester, including your practices in the class exercises + workshop assignments (particularly, e. g., Workshop 11 *Water drops* Level 1 + Level 2)

Job 01 Play a sound and dance an image

Complete the following program that:

- loads a random sound file and an image (a.jpg)
- Play the sound
- Animate the image inside the canvas:
  - moving and rotating randomly but in a *legato* style (using noise)
  - resized according to the amplitude of the sound

```
var files = ["Canon.mp3", "DeerHunter.mp3", "Popeye.mp3"];




function preload() {




}

function setup() {
  createCanvas(500, 500);









}

function draw() {
```

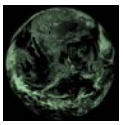
Job 02 Rotating rows and columns of images

Given 3 images:

a.jpg (colored)

b.jpg (pale red)

c.jpg (pale green)



Complete the given program that

- At each position in 10 rows x 10 columns, picks one image to show:
  In row 0, the probability of showing a.jpg or b.jpg should be 0
  In row 1, the probability of showing a.jpg or b.jpg should be 0.05 (i.e. 1/20)
  In row 2, the probability of showing a.jpg or b.jpg should be 0.10 (i.e. 2/20)
  In row 3, the probability of showing a.jpg or b.jpg should be 0.15 (i.e. 3/20)
  …
  In row 9, the probability of showing a.jpg or b.jpg should be 0.45 (i.e. 9/20)

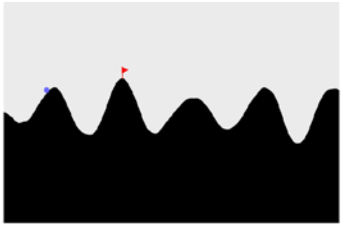
  If a.jpg or b.jpg is not chosen, then c.jpg should be shown.

- The user can press the up / down / left / right arrows to rotate the images of rows and columns.

```
var arr = [
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
];

var files = ["a.jpg", "b.jpg", "c.jpg"];


function preload() {



}

function setup() {
  createCanvas(500, 500);
```

```
}

function draw() {
```

```
}

//
function keyPressed() {
  if (keyCode == UP_ARROW) {
```



Job 03 Rolling a ball on the hills.

Complete the given program that creates as the given animation.
Note:

- The hills should be generated using the **sin function** and noise.
- The flag should be placed at the highest peak of the hills
- The ball rolling to and from the left/right margins of the canvas

```
var h = []; //height levels



function setup() {
  createCanvas(600, 400);

}

function draw() {
  background(235);

}


//Step 2: the flag function

function flag(___________________) {

}
```