CS1013 – Programming Project

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Aim

- At the end of the course you will be able to:
- Write programs which:
  - Produce graphical output
  - Respond to user input from mouse and keyboard.
  - Are structured in a way which makes them easier to develop and maintain.
- Write programs collaboratively as part of a larger team.

The course

- No exam.
- 1 hour lecture followed by 2 hour lab.
- Coursework at lab every week for first 6 weeks.
- Group project running for the remainder of the course. Assessment at labs every week.
- Project involves individual AND group components.
- Marked demo of project progress at project labs.
- Final demo to panel.
- Get better at programming now -> enjoy rest of degree much more.

Marking

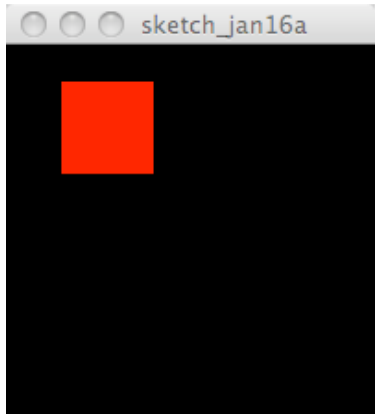
- Continuous assessment counts significantly toward mark.
- Labs marked in session, weekly. Continues for project component.
- Must complete lab n before starting n+1.
- Group project assessed by panel.
- Code seperately marked.

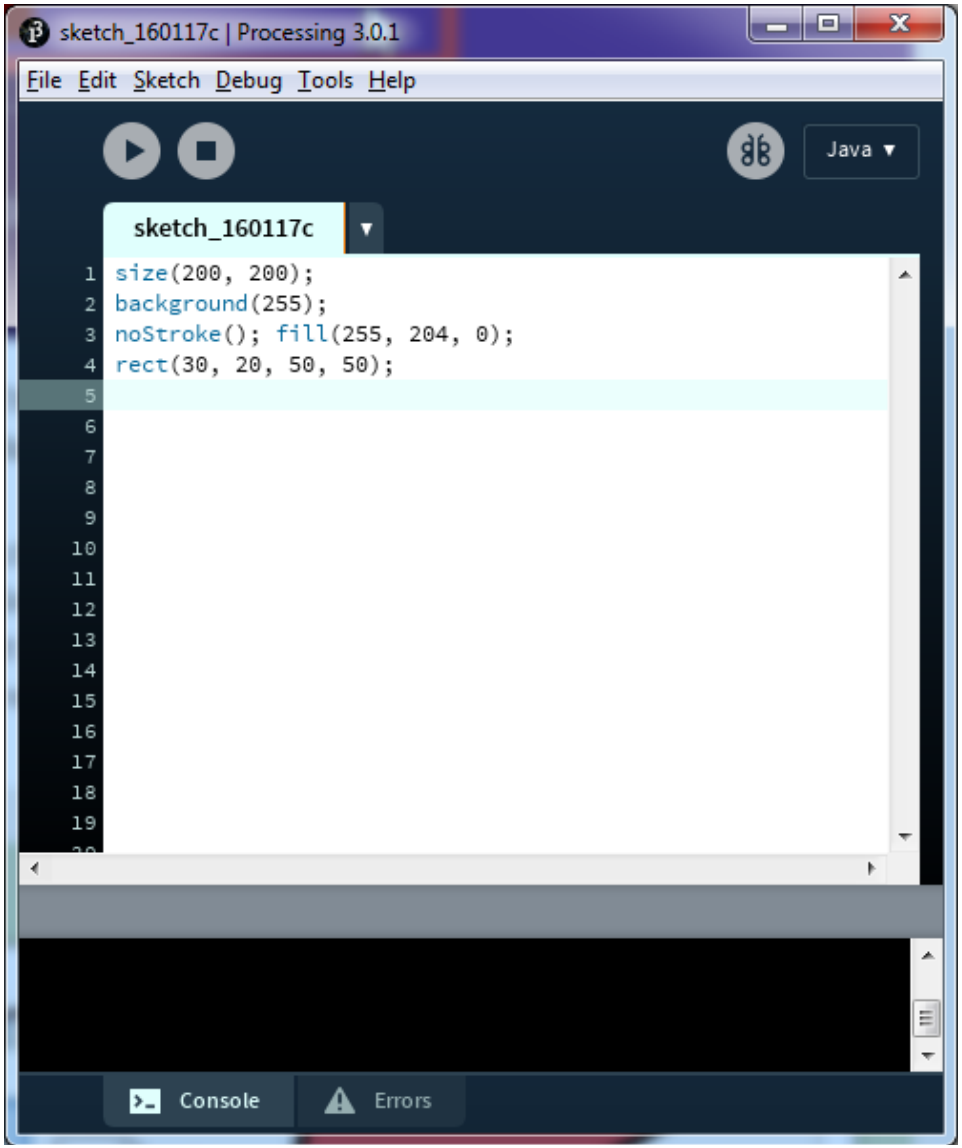
Processing.org

"Processing is an open source programming language and environment for people who want to program images, animation, and interactions."

- Based on java, but doesn't have all the same libraries.
- Lots and lots of graphics primitives.
- Simple programming environment.
- Call our programs sketches.
- Can have several files in a sketch.

Development environment

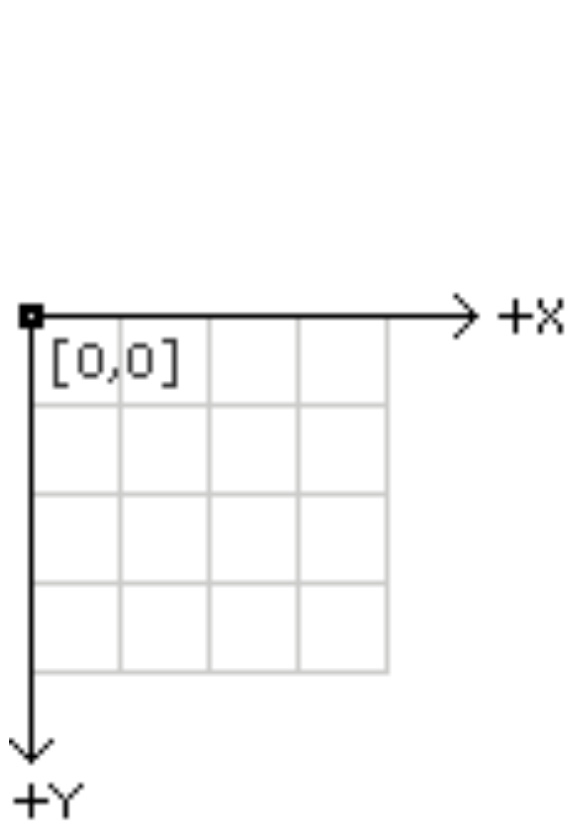


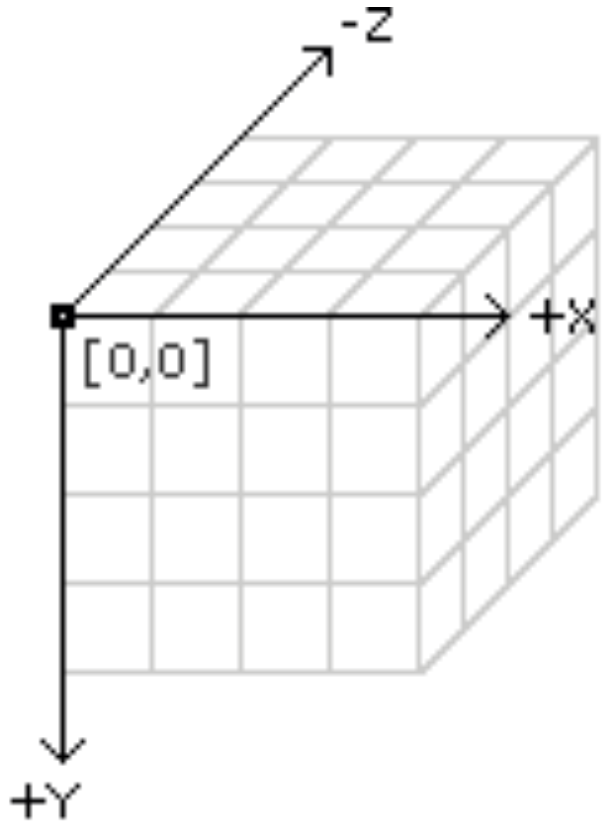


Co-ordinates

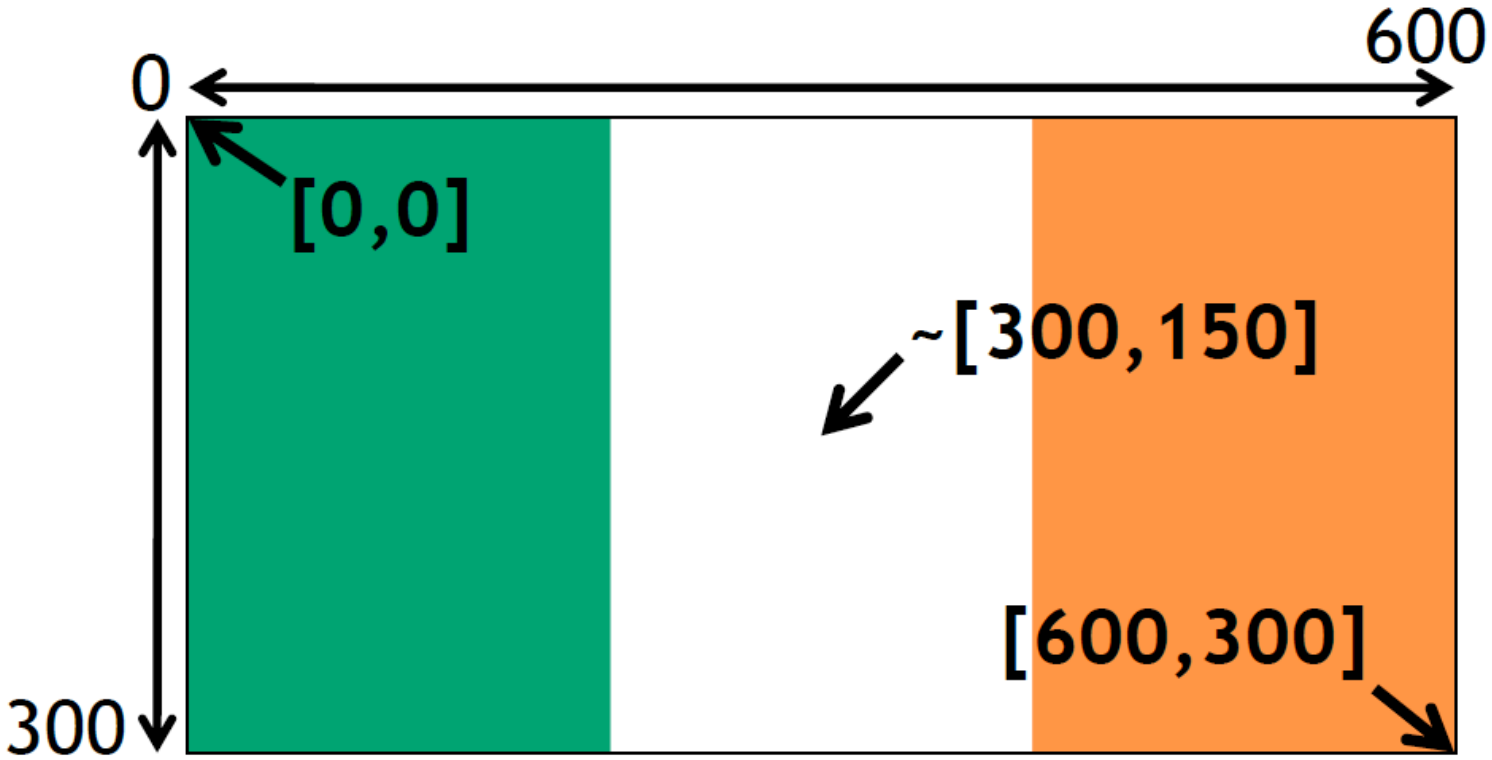
- Processing uses a Cartesian coordinate system with the origin in the upper-left corner. If your program is 320 pixels wide and 240 pixels high, coordinate [0, 0] is the upper-left pixel and coordinate [320, 240] is in the lower-right. The last visible pixel in the lower-right corner of the screen is at position [319, 239] because pixels are drawn to the right and below the coordinate.

Co-ordinates





Cartesian co-ordinates [width,height]



Bottom right pixel will be [599,299]

Basic mode

First, let's draw some pictures.

```
size(200, 200);
background(255);
noStroke(); fill(255, 204, 0);
rect(30, 20, 50, 50);
```

Here we see five graphics procedure calls.

Basic Graphics Commands

- Let's look at these procedure calls.

size(int width, int height);

background(int greycolour);

background(51);

background(255, 204, 0);

Basic Graphics Commands

```
fill(#FFCC00); // like HTML

noStroke();  // no arguments
stroke(100);
stroke(255,0,0);
stroke(#00ff00);

color yellowish = color(244, 242, 0);
```

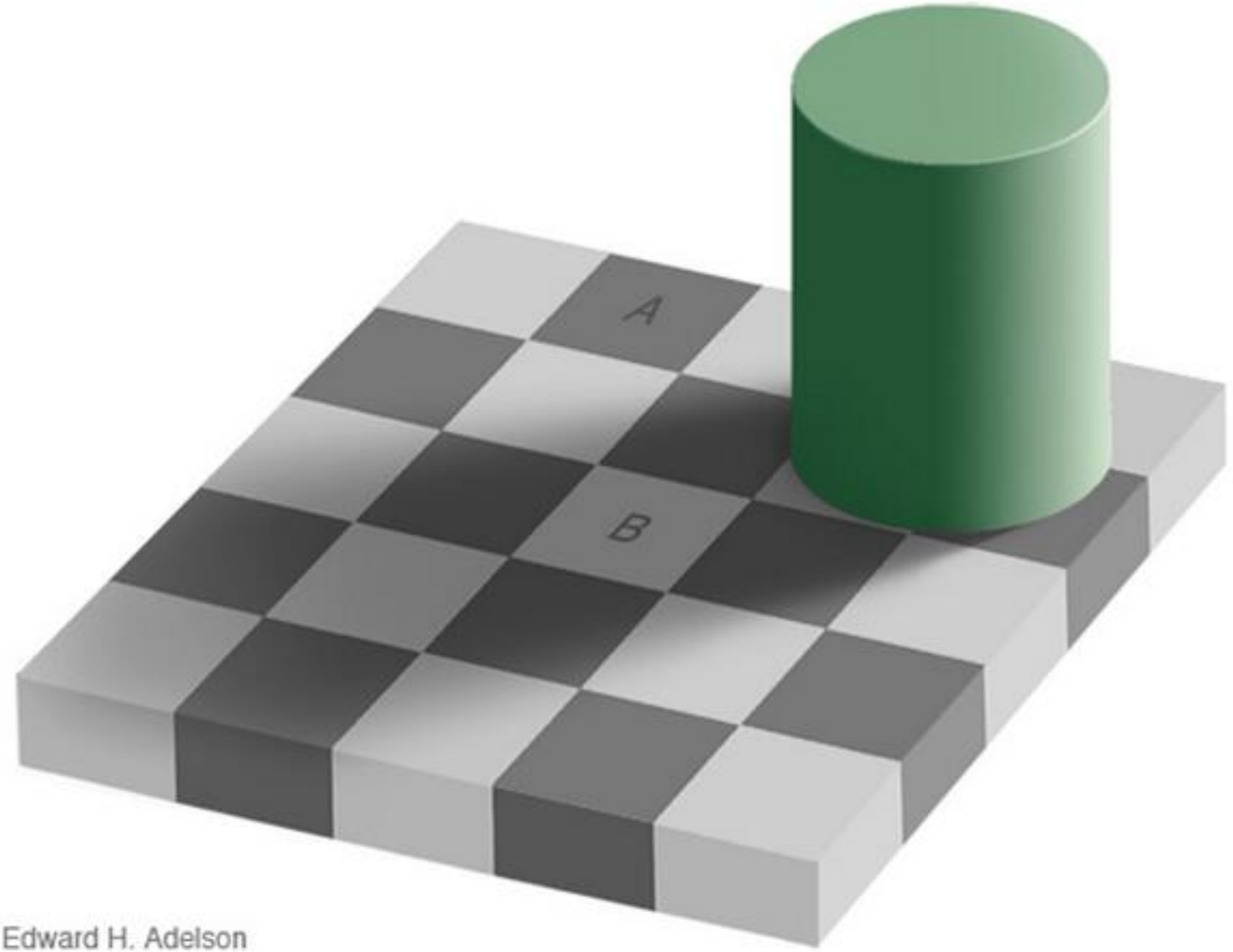
Colour

- Greyscale – black through grey to white.
- RGB – amount of red, green, blue in color.
- HSV/HSB – hue, saturation, brightness.

- How you perceive the colour of a pixel depends on what colours are near it.

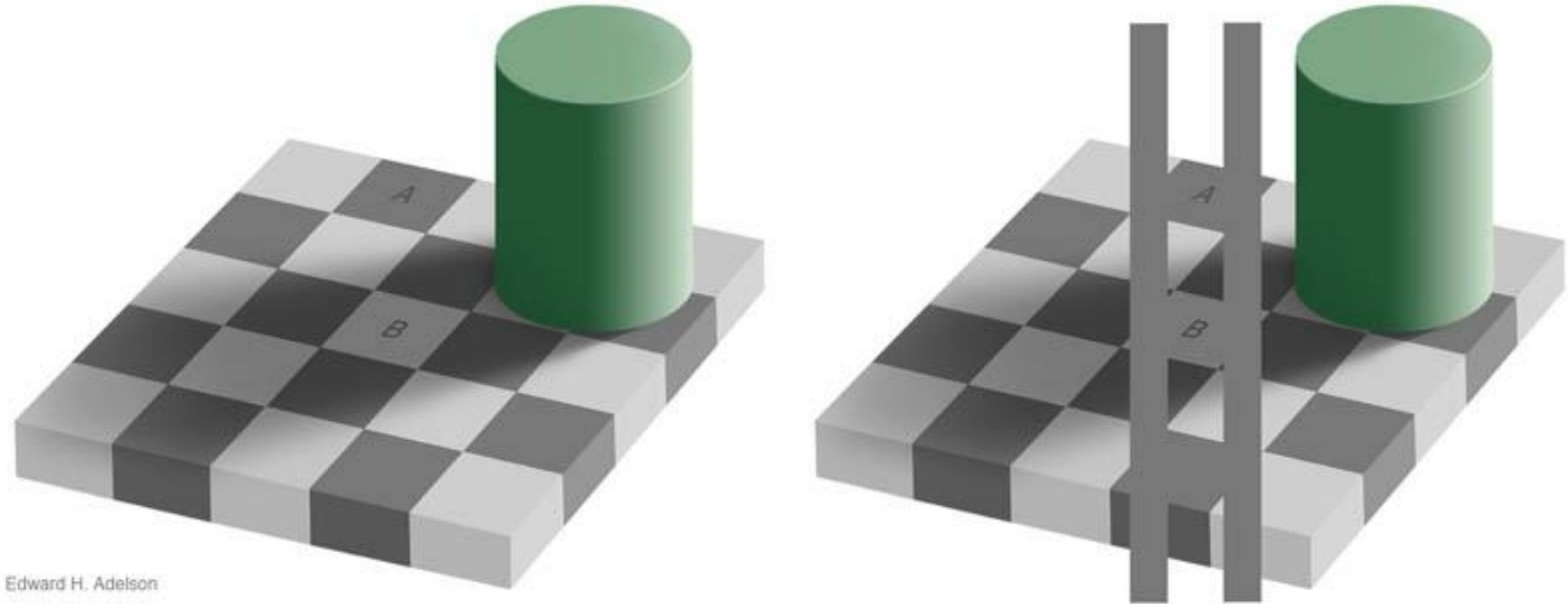
- Some colour combinations are hard to read. Some combinations cause problems for people (10% males) who are colour blind.

Color perception



Edward H. Adelson

Color perception



Drawing rectangles

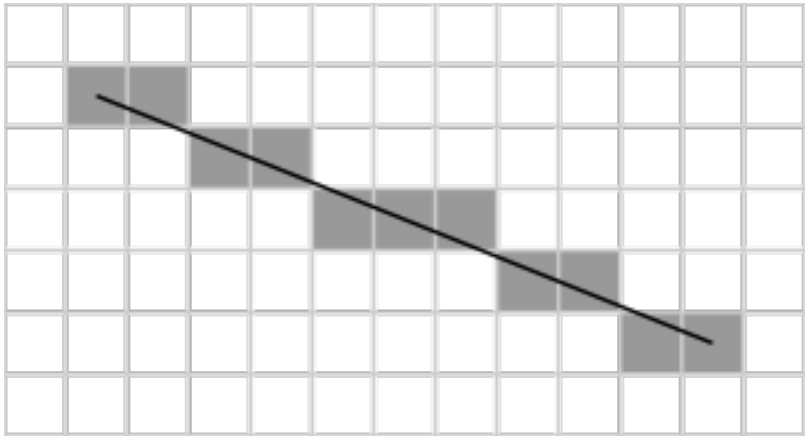
rect(x, y, width, height)

There are other rectangle modes, which you can experiment with.

There is also a line method:

line(x1, y1, x2, y2)

Bresenham's line algorithm,
presented at ACM 1963,
IBM Systems Journal 1965



Continuous mode (I)

- If we want things to move,

  we could go for the following (this is pseudo-code):

```
set_up_my_variables()
while(true){
   draw_some_stuff();
   wait_for_about_20_milliseconds();
}
```

Continuous mode (II)

- It turns out, people want this pattern quite a lot, so processing has a mode to do it. (this is pseudo-code)

```
void setup() {
   set_up_my_variables;
}
void draw() {
  draw_some_stuff;
}
```

Continuous mode (III)

```
int i;
void setup(){
  size(200, 200);
  noStroke(); fill(255, 204, 0);
  i=0;
}
void draw(){
  background(255);
  rect(i, 20, 50, 50);
  if(i++>=199) i=0;
}
```

Debugging

- Can also use println to output value of variables to message area.
- Check your boundaries. Very, very, easy to be off by 1.
- Processing is very forgiving, but other environments will not be.
- Errors may also accumulate over time.
- Be careful of division – divide by zero is a very common error.

- A crew member of the USS Yorktown mistakenly entered a zero for a data value, which resulted in a division by zero. The error cascaded and eventually shut down the ship's propulsion system. The ship was dead in the water for 2 hours and 45 minutes.

Frame Rate

- We can change how often the draw() procedure is called

```
frameRate(int rate);
```

Illusion of smooth motion

Screen refresh rate

Labs

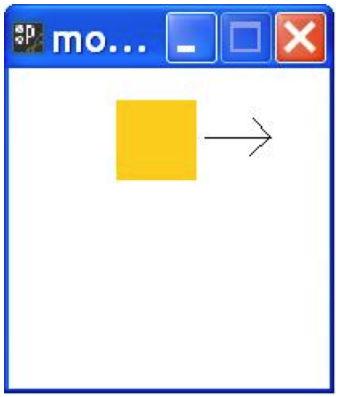
- College plagiarism policy is in the Calendar: http://www.tcd.ie/calendar/
- Install processing v 3.2.3
- ICT Labs and LG.28 for tutorial.
- Save your work to your network drive.
- Do exercise and show your solution to demonstrator. Answer the demonstrator's questions.
- No working code, no marks. No explanation, no marks.
- Always take a pen and paper for working out boundaries etc.

Exercise 1

- Produce some overlapping squares, like the following: (2.5 marks)

Exercise 2

- Write a program to animate a square moving from left to right across the screen. The square should start again when it reaches the right hand side of the window, as illustrated below. (2.5 marks)

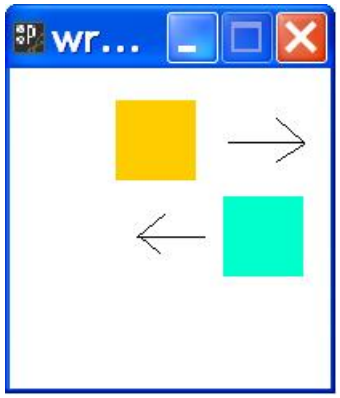


Exercise 3

- The square animation jumps back to the start. Rewrite it to make it smoothly wrap, ie. after the right hand edge of the square disappears over the right side of the window, it re-appears on the left hand side of the window. (2.5 marks)

Exercise 4

- Modify your program so that another square moves in the opposite direction to the original square (it can be on a different part of the screen). (2.5 marks)

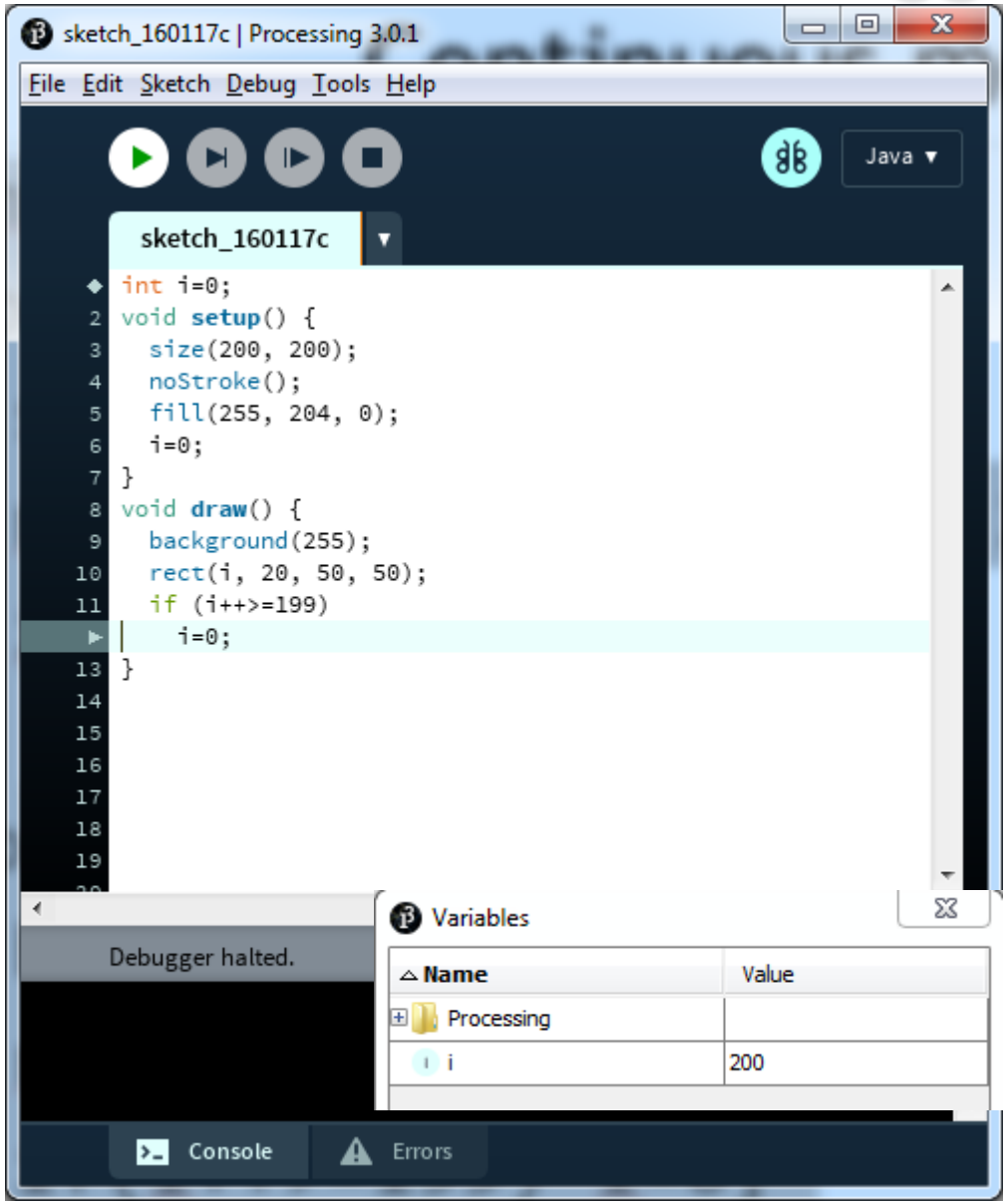


Attendance

Remember: College regulations are that all lectures, tutorials and labs are compulsory. Failure to attend will result in an NS (Non Satisfactory) being issued.

- The Senior Lecturer can deny you the chance to do exams at the end of the year and you will have to repeat the year in full, including paying fees.

Debugging



In version 3.0 select enable debugger from the Debug menu.

Set breakpoints where you want program to stop.

Use tweak mode to try different constants.