Chapter 4
Summary/review

• coordinate system
• basic drawing commands and their parameters (rect, line, ellipse, background, stroke, fill)
• color model - RGB + alpha
• Processing IDE - entering/saving/running
• top to bottom statement execution - order matters
• function call syntax (e.g. rect(10,20,30,40); )
• println() for debugging
• comments
• setup & draw
• system variables - mouseX, pmouseY, width, height, ...
• translate
• Did I leave off something important?
What is a variable?

- A named location in the computer’s memory.
- A variable stores values

- $\text{mouseX}$
- $\text{mouseY}$
- $\text{width}$
- $\text{height}$
- $\text{fontColor}$
- $\text{userName}$
Variables

• store/remember values
• can be changed
• must be declared to store a particular kind of value (e.g. whole number, fraction, character, color, image, boolean)
• should have a descriptive name
• start with letter
• then also include numbers
• no spaces
void setup() {
    size(500, 500);
    noFill();
}

int diameter = 0;

void draw() {
    ellipse(width/2, height/2, diameter, diameter);
    diameter = diameter + 10;
}

What does this display?
A) many nested circles (like a target) growing in size
B) a white circle growing in size
C) a black circle growing in size
D) a pulsing images of circles growing and shrinking
E) nothing (a circle with diameter 0)
/ draw a simple house
int houseX = 50;
int houseY = 100;
int houseWidth = 100;
rect(houseX, houseY, houseWidth, houseWidth/2);
triangle(houseX, houseY, houseX+houseWidth/2,
        houseY-houseWidth/2, houseX+houseWidth, houseY);
/ draw a simple house
int houseX = 50;
int houseY = 100;
int houseWidth = 100;
rect(houseX, houseY, houseWidth, houseWidth/2);
triangle(houseX, houseY, houseX+houseWidth/2,
        houseY-houseWidth/2, houseX+houseWidth, houseY);

// draw another house - lines are copied from above
houseX = 200;
houseWidth = 50;
rect(houseX, houseY, houseWidth, houseWidth/2);
triangle(houseX, houseY, houseX+houseWidth/2,
        houseY-houseWidth/2, houseX+houseWidth, houseY);

// draw another house - lines are copied from above
houseX = 300;
houseY = 200;
rect(houseX, houseY, houseWidth, houseWidth/2);
triangle(houseX, houseY, houseX+houseWidth/2,
        houseY-houseWidth/2, houseX+houseWidth, houseY);
void setup() {
    size(400, 400);
}

// draw a simple house
float houseX = 50;
float houseY = 100;
float houseWidth = 100;
void draw() {
    rect(houseX, houseY, houseWidth, houseWidth/2);
    triangle(houseX, houseY, houseX+houseWidth/2, houseY-houseWidth/2, houseX+houseWidth, houseY);
    houseX = houseX + 1.5*houseWidth;
    houseY = houseY + 0.75*houseWidth;
    houseWidth = houseWidth / 2;
}
/* Write a program that shows a 10x10 circle moving from the top center of the display down to the bottom center. */
/* Write a program that shows a 10x10 circle moving from the top center of the display down to the bottom center. */

// Can you make it go slower or faster?
void setup() {
    size(200, 200);
}

void draw() {
    background(255);
    int xPos = 0;
    ellipse(xPos, height/2, 20, 20);
    xPos = xPos + 1;
}

What does this draw?
A) circle moving across the screen left to right
B) circle moving across the screen right to left
C) circle moving across the screen top to bottom
D) circle moving across the screen bottom to top
E) half-circle on the left edge not moving
Declaring v. Initializing v. Assigning

- int carFront; // declare
- int carFront = 100; // declare and initialize
- carFront = carFront - 1; // assign
Modulus (%)

• 17 / 3 in Java is 5 (goes in evenly 5 times)
• 17 % 3 in Java is 2 (17 - 3*5 = 2)
• What is 8 % 5?
• What is 150 % 10?
• What is 17 % 2?
int counter = 0;
void draw() {
    background(255);
    int xPos = width - counter%width;
    int yPos = counter%height;
    fill(255,0,0);
    ellipse(xPos, yPos, 5, 5);
    fill(0,255,0);
    ellipse((2*counter)%width, (2*counter)%height, 5, 5);
    counter = counter + 1;
}

A. The red one is moving faster.
B. One is moving top to bottom following a diagonal, the other is moving bottom to top following a diagonal.
C. Both A and B
D. Neither A nor B
int frontOfCar = 100;
int topOfCar = 100;
int lengthOfCar = 200;
int carBodyHeight = lengthOfCar/4;
int wheelDiameter = lengthOfCar/4;

// draw the body
rect(frontOfCar, topOfCar, lengthOfCar, carBodyHeight);

// draw the wheels
ellipse(frontOfCar + wheelDiameter, topOfCar + carBodyHeight, wheelDiameter, wheelDiameter);
ellipse(frontOfCar + lengthOfCar - wheelDiameter, topOfCar + carBodyHeight, wheelDiameter, wheelDiameter);

// draw the windshield
// use carBodyHeight to also control the size of the windshield
line(frontOfCar + carBodyHeight, topOfCar, frontOfCar + 2 * carBodyHeight, carBodyHeight);
```cpp
int frontOfCar = 100;
int topOfCar = 100;
int lengthOfCar = 200;
int carBodyHeight = lengthOfCar / 4;
int wheelDiameter = lengthOfCar / 4;

void draw() {
    background(255); // 255 means white
    fill(255); // the inside of the body should be white
    // draw the body
    rect(frontOfCar, topOfCar, lengthOfCar, carBodyHeight);
    // draw the wheels
    ellipse(frontOfCar + wheelDiameter, topOfCar + carBodyHeight, wheelDiameter, wheelDiameter);
    ellipse(frontOfCar + lengthOfCar - wheelDiameter, topOfCar + carBodyHeight, wheelDiameter, wheelDiameter);
    line(frontOfCar + carBodyHeight, topOfCar, frontOfCar + 2 * carBodyHeight, topOfCar - carBodyHeight);
    frontOfCar = frontOfCar - 1; // move car to the left
}
```
What is printed when the 2nd frame is drawn?

A) 99   B) 99   C) 99   D) 100
25   24   24.75   25
25   24   24.75   25
Primitive Types

• boolean - true or false
• char - ‘a’, ‘b’, ‘c’, ...
• byte - small integer -128 to 127
• short - bigger integer -32768 to 32767
• int - even bigger integer +/- 2 billion
• long - really big integer
• float - numbers with fractional parts 3.1415
• double - like float but more precision
System Variables (Processing)

- mouseX, mouseY
- pmouseX, pmouseY
- width, height
- frameCount
```java
void setup() {
    size(400, 400);
}

void draw() {
    fill(255-abs(mouseX-pmouseX));
    rect(pmouseX, pmouseY, mouseX, mouseY);
}
```
Where should the line “background(255);” be placed so that the sketch shows just a single moving rectangle?

Choose option E if it would work with either C or D.
Type Conversion/Casting

```java
int houseWidth;
houseWidth = houseWidth * .75;
```
What is the value of x in...

- `int x, y = 7;`
- `x = y / 8;`
- `x = (-y) / 8;`
- `x = y / 3;`
- `x = y % 3;`
- `x = int(y*1.5);`
- `x = (int)y*1.5;`
What is the value of z in...

```c
int x = 6, y = 10;
float z;
z = x / y;
```

A) 0
B) .6
C) 1
D) none of the above - it is a syntax error
void setup() {
    size(500, 500);
    fill(255, 0, 0);
}

void draw() {
    char letter = (char)('A' + random(26));
    text(letter, mouseX, mouseY);
}
This program draws a square that changes color every frame and follows the mouse.

```cpp
float r;
float g;
float b;

void setup() {
  size(400,400);
  background(150);
}

void draw() {
  background(150);
  r = random(255);
  g = random(255);
  b = random(255);
  fill(r, g, b);
  rect(mouseX, mouseY, 50, 50);
}
Variable Names

• The rules
  – start with a letter, _ or $
  – 2nd and on can also be a digit

• The guidelines
  – descriptive
  – start with lower case
  – use camelCaseToSetOffMultipleWords
Variables – Recap

• declare globally if used to remember values from one call of draw() to the next
• declare within draw() (or setup()) if needed ONLY for that one execution of method
• give the type only once, in the declaration (which is different from an assignment)
void setup() {
    size(400, 400);
    yPos = height;
    xPos = width/2;
}

int xPos, yPos;

void draw() {
    background(255);
    ellipse(xPos, yPos, 15, 15);
    yPos = yPos - 1;
    xPos = xPos - frameCount/(height/2);
}

A. The circle moves from bottom center to top center.
B. The circle moves from bottom center to the middle, then diagonally to the upper left corner.
C. The circle moves from the bottom center to the middle, then diagonally to the upper right corner.
D. The circle moves from the bottom center to the middle then stops.