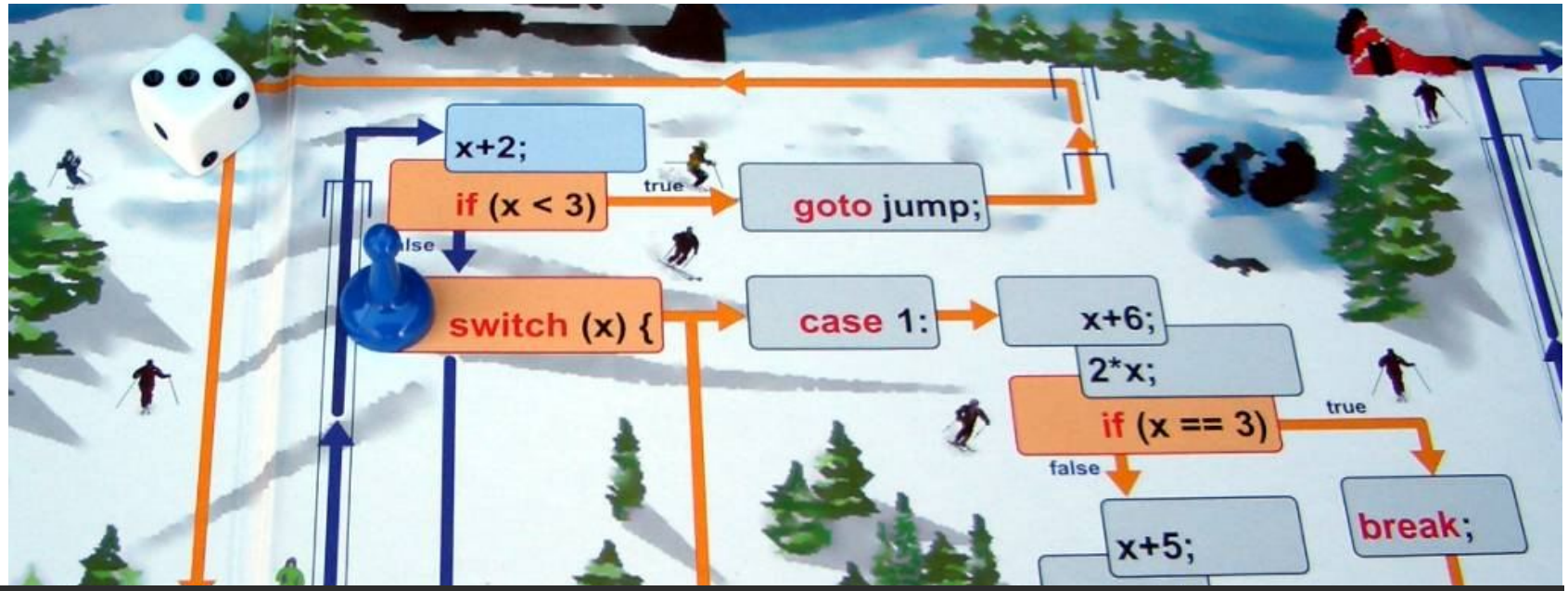


Drawing / Variables / Data types / Operators

Instructor: Neng-Hao (Jones) Yu
Time: Mon. 6:10 – 9:10pm
Place: 商院大樓 260509
Course website: http://programming101.cs.nccu.edu.tw

How to Play

上課參與	XP	HP	Card (抽卡機會)
出席	50	10	
發問問題	10	10	1
回答問題	20	10	1
完成課堂小組活動	30	10	1
完成課堂個人練習	40	10	1
曠課		-100	
請假		-50	

Topics

- How to write a program?
- Draw something
- Variables and Constants
- Operators
- Data types

How to write a program?

- **Program: a sequence of instructions to the computer**

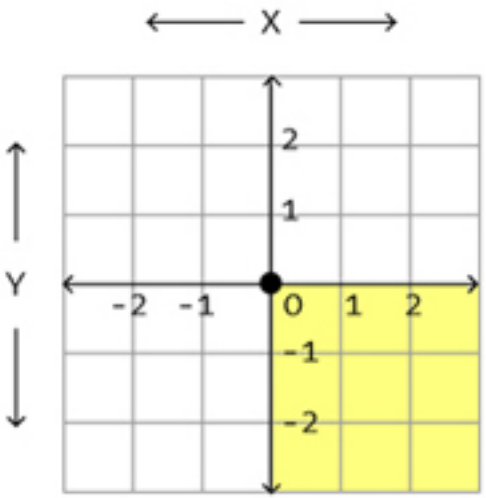
e.g. Make a 「翡翠檸檬茶」

1. 先將茶包放入熱水浸泡，茶水差不多泡5分鐘左右，盡量泡出濃郁茶湯。
2. 檸檬用湯匙榨出汁，如果檸檬太小可以用兩顆。
3. 熬煮後的蔗糖加20cc蜂蜜。
4. 加水及冰塊用果汁機攪打成700cc

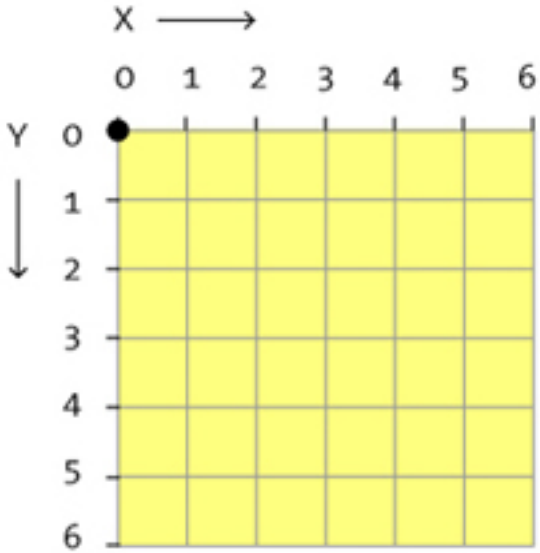
“pseudo-code” **statement & syntax**

*自製黃金比例翡翠檸檬茶

Screen coordinates



Cartesian coordinate system

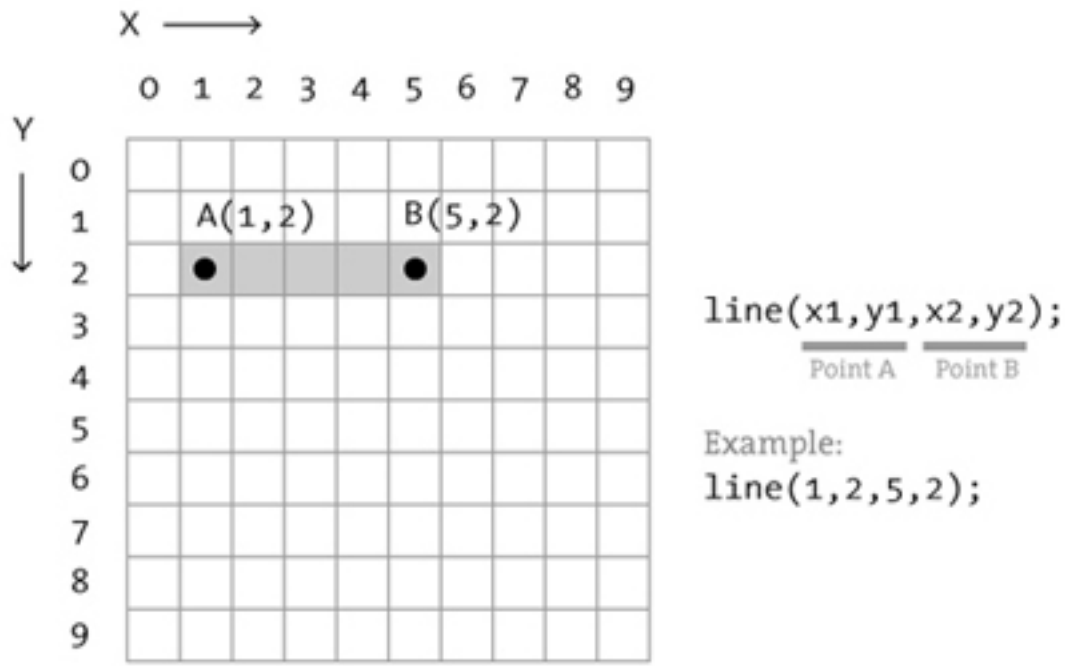


Screen coordinate system

Syntax:

```
funcName(parameters); //use ";" to terminate a statement
size(200, 200);  //create a 200x200 canvas
```

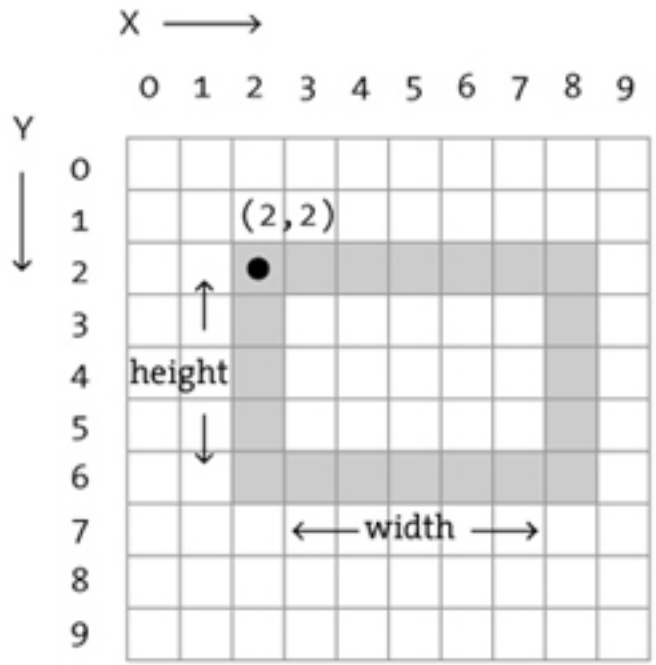
Draw a line




```
// comment: draw a line from A to B
line(x1,y1,x2,y2);
```

http://processing.org/reference/line_.html

Draw a rectangle




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

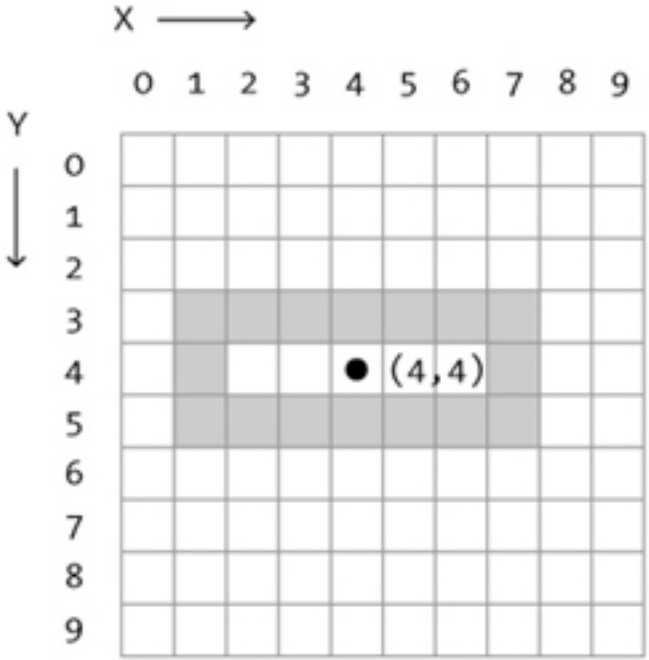
Example:

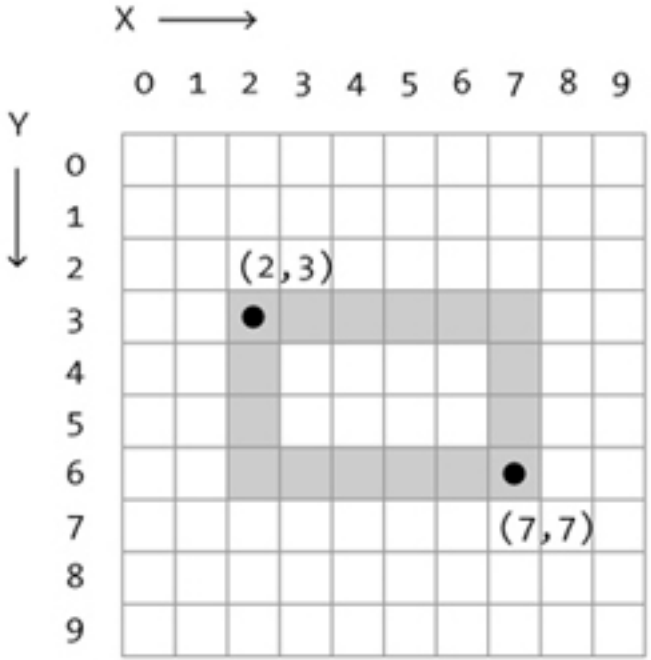
```
rect(2,2,7,5);
```

```
rect(x,y,w,h);
```

http://processing.org/reference/rect_.html

Rectangle mode






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

Example:

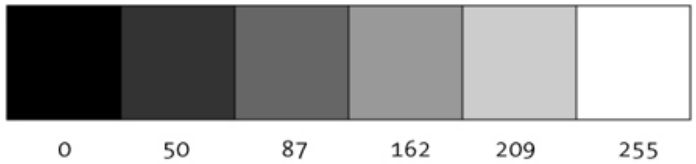
```
rectMode(CORNERS);
rect(2,3,7,7);
```

```
rectMode(CENTER);
rect(4,4,7,3)
```

http://processing.org/reference/rectMode_.html

Color

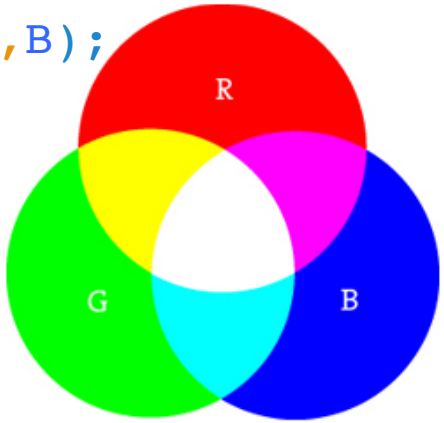
Grayscale Color



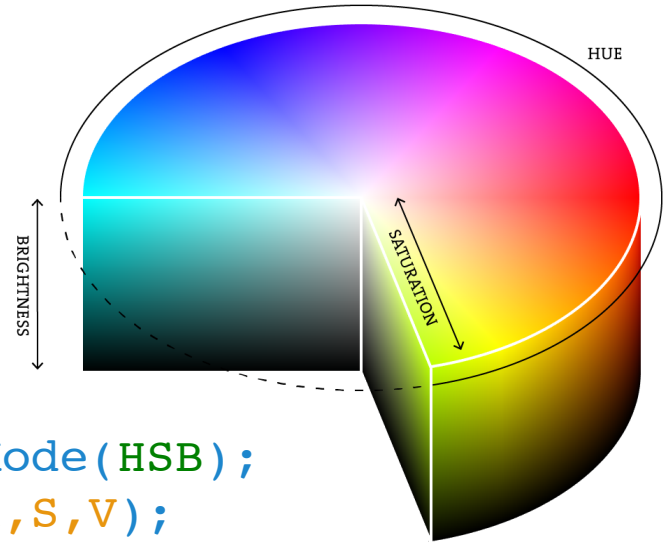

```
background(50);
stroke(255);
fill(162);
```

RGB Color

```
fill(R,G,B);
```



HSB Color



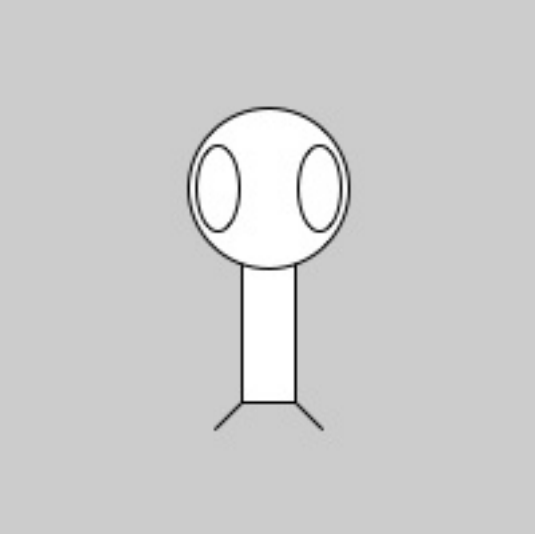

```
colorMode(HSB);
fill(H,S,V);
```

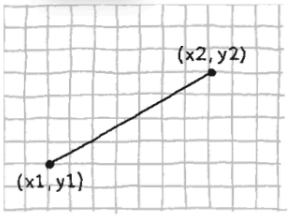
Draw something

http://processing.org/reference/

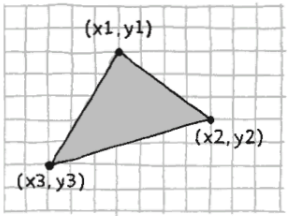
→ 2D Primitives

Exercise (8mins)

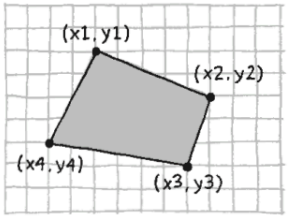




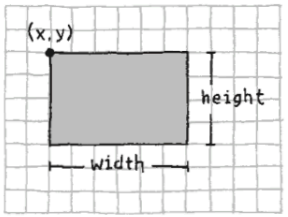
line(x1, y1, x2, y2)



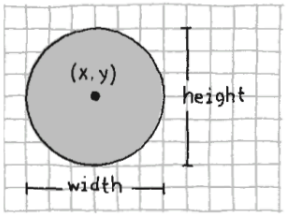
triangle(x1, y1, x2, y2, x3, y3)



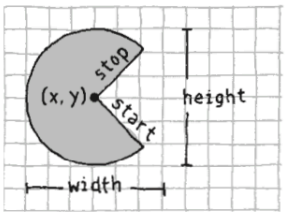
quad(x1, y1, x2, y2, x3, y3, x4, y4)



rect(x, y, width, height)



ellipse(x, y, width, height)



arc(x, y, width, height, start, stop)

Variables

- How to draw the alien at different position?
  - specify the initial position of alien's head
  - calculate new positions of the body and the leg
  - redraw

use **variable** → **computer has memory to store information**

```
• age:    How old are you?
• height: How tall are you?
• score:  How many points you have earned?
```

Variables

- Declare the variable

Case sensitivity!

```
int myAge;
```

- Initialize the variable

Data assignment (assignment operator)

```
myAge = 18; // assign value(right) to variable(left)
```

- Use the variable

```
println(myAge);
```

Expression

```
int myAge;
int birthYear = 1988;   // declare and initialize
```

Expression

```
myAge = 2013-birthYear+1;
```

```
myAge = 18;   // reassign value
```

ESP game:
https://gist.github.com/jonesfish/d6889c35a961d1eb5153

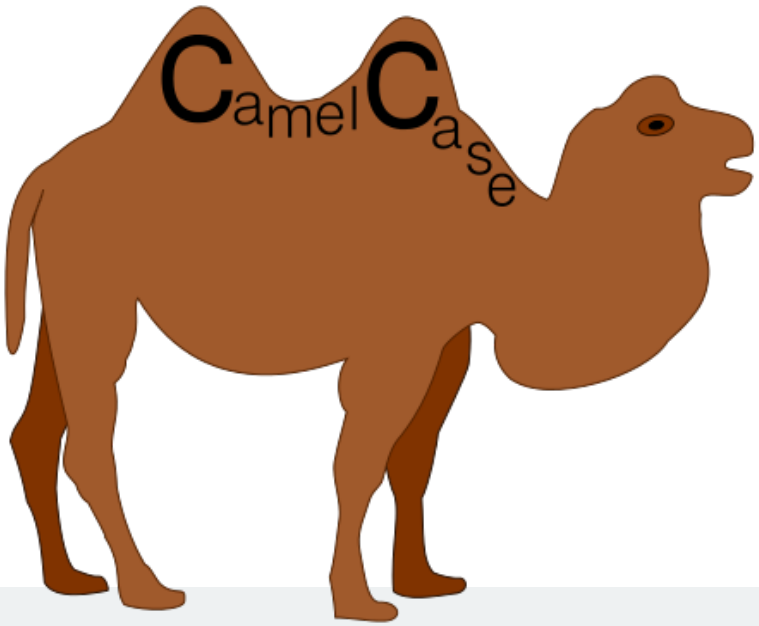
好的程式碼從取好變數名字開始

Variable naming conventions

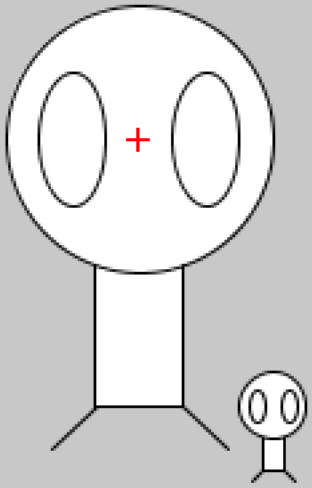
- Variable names **cannot be a reserved word** or keyword.
  - catch, this, class, throw … (http://processing.org/reference/)
- Variable names must **start with a letter**, an underscore, or a dollar sign
- Variable names **cannot use special characters** (except _ and $ in certain situations)
- Variable names must be **unique**
- Use **descriptive variable names** so that the content of any variable is obvious

Variable naming conventions

- Use **camel case**: Start with a lowercase letter and include uppercase letters.
- e.g. `totalCost` or `mySecretNumber`



Exercise (10mins)



Draw two aliens with specified headX, headY and headSize

Operators and operands

operands

```
int sumNumber = 2 + 3 * 4;
```

operators

```
// sumNumber is now 14

println(5 + 5); // 10

println("Hello"+"World"); // HelloWorld

println("5" + "5"); // ?
```

operator overloading

Arithmetic operators

+	Addition : Adds numeric expressions
-	Subtraction : Negates or subtracts numeric expressions
*	Multiplication : Multiplies two numerical expressions
/	Division : Divides expression1 by expression2
%	Modulo : Calculates the remainder of division
++	Increment : Adds 1 to a numeric expression
--	Decrement : Subtracts 1 from a numeric expression

Type of operators

- Interfix: 5 + 3 - 2
- Prefix: -55
- Postfix: foo++ ➔ foo = foo + 1

- Unary → ++ (one operand)
- Binary → + - * / (two operands)
- Ternary → ?: (three operands)

```
int xNum = 0;

println(++xNum); // 1

println(xNum); // 1


int yNum = 0;

println(yNum++); // 0

println(yNum); // 1
```

Compound assignment operators

```
var foo=5;

foo += 5;   // foo = foo + 5;

-=

*=

/=

%=
```

Operator precedence

```
int sumNumber = 2 + 3 * 4;

println(sumNumber);

sumNumber = (2 + 3) * 4 % 3;

println(sumNumber);
```

Name	Symbol	Examples
Parentheses	`()`	`a * (b + c)`
Postfix, Unary	`++ -- !`	`a++ --b !c`
Multiplicative	`* / %`	`a * b`
Additive	`+ -`	`a + b`
Relational	`> < <= >=`	`if (a > b)`
Equality	`== !=`	`if (a == b)`
Logical AND	`&&`	`if (mousePressed && (a > b))`
Logical OR	`||`	`if (mousePressed || (a > b))`
Assignment	`= += -= *= /= %=`	`a = 44`

Data types

- The way values of that type can be stored.
  - `int: integer`
  - `float: floating-point number`
  - `char: single character`
  - `String: string of words`
- Advantages:
  - less bugs
  - efficient memory allocation

Data types

- Size and value range of data types:

	Name	Description	Range of values
32bits	*int*	Integers (whole numbers)	–2,147,483,648 to 2,147,483,647
32bits	*float*	Floating-point values	–3.40282347E+38 to 3.40282347E+38
1bit	*boolean*	Logical value	true or false
16bits	*char*	Single character	A–z, 0–9, and symbols
	String	Sequence of characters	Any letter, word, sentence, and so on
	PImage	PNG, JPG, or GIF image	N/A
	PFont	VLW font; use the Create Font tool to make	N/A
	PShape	SVG file	N/A

Type conversions

- **Implicit** conversion, also called **coercion**, is sometimes performed at runtime. It happens in
  - In assignment statements
  - In expressions using certain operators, such as the addition (+) operator

- **Explicit** conversion, also called **casting**, occurs when your code instructs the compiler to treat a variable of one data type as if it belongs to a different data type.

```
int a;                  b= a / 2.0;

float b;                // or

a= 55;                  b= (float)a / 2;

b= a / 2;               // or

println(b);             b= float(a) / 2;

// what is the value of b?
```

http://processing.org/examples/datatypeconversion.html

Constants

- Must be initialized
- Cannot change the data in it
- Constant names are all caps with words separated by an underscore, e.g.

```
final float MILES_KM_CONVERSION_VALUE = 1.61;
final float PI = 3.14;
```

```
// convert mile to km
final float MILES_KM_CONVERSION_VALUE = 1.61;

float km = 30 * MILES_KM_CONVERSION_VALUE;

println(km);
```

Exercise (5mins):
Write a program to calculate the area of a circle given a radius