Conditional Branching
CMPT 140

If-statements

If-statements:
Asking questions about data

If-statements

What kind of questions might we want to ask?

Relational Operators

$$== \quad != \quad > \quad < \quad <= \quad >=$$

Exercise 1

Given the following variables:

```
x = 10
y = 2
z = 5
title = "How To Fly"
author = "Penguin"
publisher = "iLike2Publish"
```

Evaluate the following expressions:

(a) y*z == x

(b) x > len(author)

(c) title < author

(d) author > publisher

Exercise 2

Given the following pre-defined variables:

```
fish_a              # string: fish A's name
fish_b              # string: fish B's name
max_name_length     # integer: maximum length for names
```

Write Python expressions to determine:

(a) Whether fish_a and fish_b refer to the same values

(b) Whether fish_a occurs after fish_b in lexicographical ordering

(c) Whether the length of fish_b exceeds max_name_length

(d) Whether the shorter (length-wise) of fish_a and fish_b is less than or equal to max_name_length

Exercise 3

Create a complete Processing program using a 400x400 canvas where:

(a) Initially, the **top half** of the canvas is **white** and the **bottom half** is **black**

(b) **If the mouse is clicked anywhere on the bottom half of the canvas**, the bottom half turns white and the top half turns black

(c) **If the mouse is clicked anywhere on the top half of the canvas**, the top half turns white and the bottom half turns black

Boolean Operators

and   or   not

Exercise 4

Given the following variables:

```
a = True
b = False
c = True
```

What do the following Boolean expressions evaluate to (`True` or `False`)?

(a) `not a`

(b) `a and b`

(c) `b or a`

(d) `b and c or a`

(e) `not c or b`

(f) `not b and c`

(g) `b or a and not b and c`

Exercise 5

Given the following variables describing fish:

```
has_dorsal_fin     # whether fish has a dorsal fin
has_scales         # whether fish has scales
has_stripes        # whether fish has stripes
has_spots          # whether fish has spots
```

Use logical operators to write Python expressions to determine if a fish:

(a) Does not have scales

(b) Has both stripes and spots

(c) Has at least one of stripes or spots

(d) Is missing at least one of a dorsal fin or scales

(e) Has stripes or spots, but not both

Exercise 6

Given the following variables:

```
x = 10
y = 2
z = 5
```

Evalute the following expressions:

(a) not x < y

(b) x > y and y > z

(c) x == z or x > z

(d) not (z < x and y < x)

(e) x+z > x+y or z < x and y < x

(f) y < x-z or not x**y > y**x

(g) (x/y == z or x+z > z) and not (y*x < y+x)

Exercise 7

Write **a function** that checks if a given point is inside a box

- **function header:** inside_box(x, y, box_x, box_y, w, h)
- (x,y): the point we want to check
- (box_x, box_y): top-left corner of the box
- w, h: width and height of the box
- **return** True if (x,y) is inside the box, False otherwise
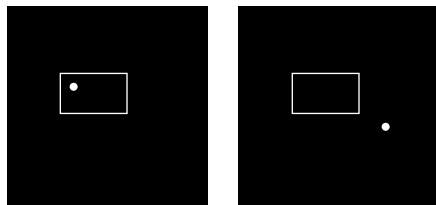

Figure: On left: inside the box. On right: outside the box.

Exercise 8

Suppose we are given functions that return a letter grade based on a numerical grade:

```
def letter_grade_1(grade):
  letter = "F"
  if grade > 85:
    letter = "A"
  if grade > 70:
    letter = "B"
  if grade > 50:
    letter = "C"
  return letter
```

```
def letter_grade_2(grade):
  letter = "F"
  if grade > 85:
    letter = "A"
  elif grade > 70:
    letter = "B"
  elif grade > 50:
    letter = "C"
  return letter
```

If 75 is given as an argument to both functions, what do they return and why?

Exercise 9

Pretend we're planting rare yellow flowers in a garden:

```python
# the number of remaining flowers to plant
flowers_to_plant = 5

def setup ():
    size (300 ,300)
    background (0 ,100 ,0)

def draw ():
    return

def mousePressed ():
    # draws flower at cursor , if able to
    global flowers_to_plant
    flowers_to_plant = plant_flower ( flowers_to_plant )
```

We only have a maximum of five flowers available, represented by
the variable flowers_to_plant.

Exercise 9 (ctn'd)

Your job: Define the function `plant_flower()`.

- Gets called when the mouse is clicked
- The "flower" is just a yellow circle
- If there are no flowers left (remember, we only have 5!), print a message to the console instead of placing a new flower
- Returns the remaining number of flowers left to plant
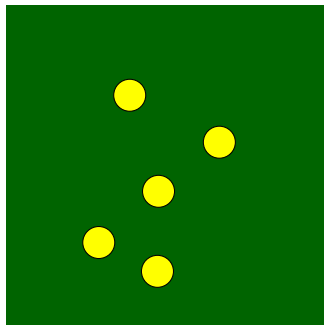
Interlude: Colour Variables

Processing gives us a convenient way to store an RGB colour in a variable.

```
shade = color(200, 100, 0)
```

We can then use the variable `shade` as an argument to colour-related functions (like `fill()` and `stroke()`).

Exercise 10

Write Processing code which draws a **coloured** circle that follows the mouse.

- initially, the circle is red
- the user can change the circle's colour by pressing the 'r' (for red), 'g' (for green) or 'b' (for blue) keys
- if any other key is pressed, display an error message on the console.
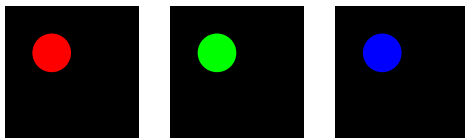
Extra Practice

Given the following **integers** describing fish:

```
n_dorsal_fins      # number of dorsal fins the fish has
n_scales           # number of scales the fish has
n_stripes          # number of stripes the fish has
n_spots            # number of spots the fish has
n_gills            # number of gills the fish has
```

Write Python expressions to determine if a fish:

(a) Does not have stripes

(b) Has more spots than stripes and has at least one dorsal fin

(c) Has either more spots than stripes or has exactly nine stripes

(d) Does not have more than two dorsal fins and does not have more stripes than spots

(e) Has at least as many stripes as spots and more than twelve stripes, or has more spots than stripes though no more than thirteen spots