CSc 110, Spring 2018

Lecture 11: `if / else`

Adapted from slides by Marty Stepp and Stuart Reges

Exercise: what is wrong with this code?

```
# prints the location of a ball with an initial velocity of 25 accelerating
# due to gravity
def main():
    v01 = 25
    a = 9.81
    for i in range(0, 60):
        displacement(v0, a, t)
        print(d)

def displacement(v0, a, t):
    d = v0 * t + 0.5 * a * (t ** 2)
    return d

main()
```

Example

- If you drop two balls, which will hit the ground first?
  - Ball 1: height of 600m, initial velocity = 25 m/sec downward
  - Ball 2: height of 500m, initial velocity = 15 m/sec downward

- Write a program that determines how long each ball takes to hit the ground (and draws each ball falling).

- Total time is based on the force of gravity on each ball.
  - Acceleration due to gravity $\cong$ 9.81 m/s^2, downward
  - Displacement = $v_0\, t + \frac{1}{2}\, a\, t^2$

Ball solution

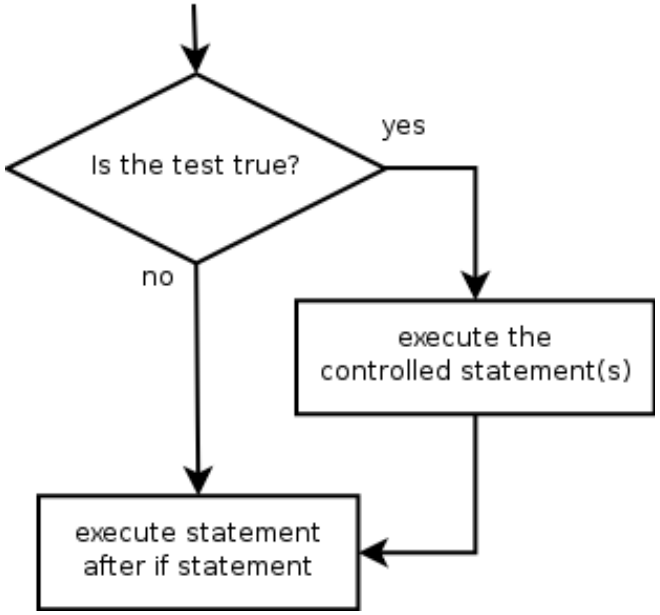
```
# Simulates the dropping of two balls from various heights.
def main():
    panel = DrawingPanel(600, 600)

    ball1x = 100
    ball1y =   0
    v01 = 25
    ball2x = 200
    ball2y = 100
    v02 = 15

 # draw the balls at each time increment
    for time in range(60):
        disp1 = displacement(v01, time, 9.81)
        panel.fill_oval(ball1x, ball1y + disp1, 10, 10)
        disp2 = displacement(v02, time, 9.81)
        panel.fill_oval(ball2x, ball2y + disp2, 10, 10)

        panel.sleep(50)    # pause for 50 ms
        panel.fill_rect(0, 0, 600, 600, "white")
...
```

The `if/else` statement

The `if` statement

Executes a block of statements only if a test is true

```
if test:
    statement
    ...
    statement
```



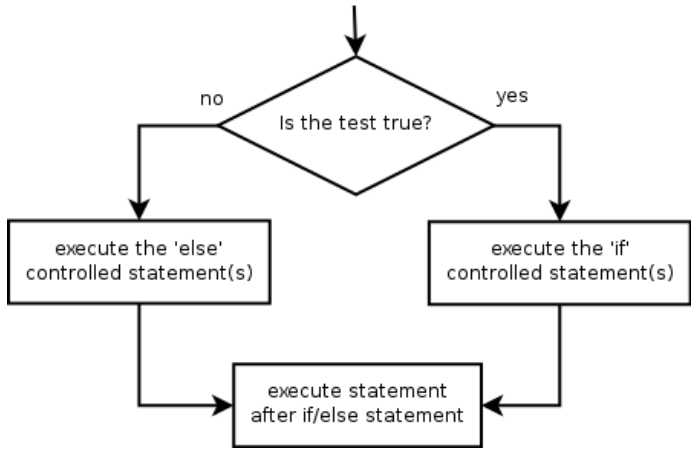
- Example:

```
gpa = float(input("gpa? "))
if gpa >= 2.0:
    print("Application accepted.")
```

The `if/else` statement

Executes one block if a test is true, another if false

```
if test:
    statement(s)
else:
    statement(s)
```



- Example:

```
gpa = float(input("gpa? "))
if gpa >= 2.0:
    print("Welcome to Mars University!")
else:
    print("Application denied.")
```

Relational expressions

- `if` statements use logical tests.

```
if i <= 10: ...
```

  - These are `boolean` expressions

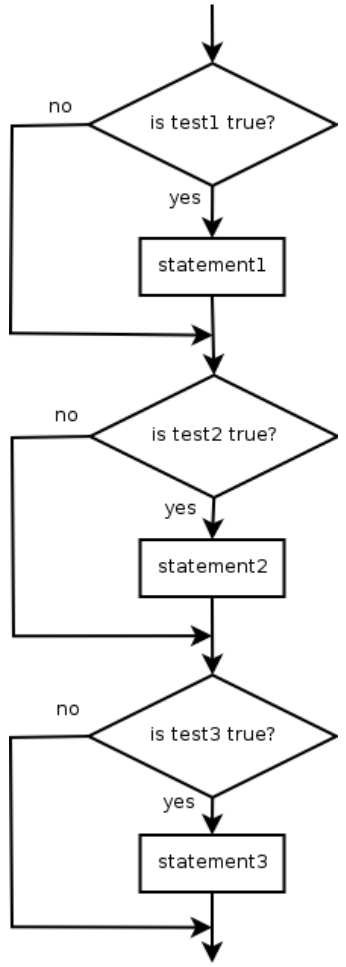
- Tests use *relational operators*:

Operator	Meaning	Example	Value
==	equals	`1 + 1 == 2`	`True`
!=	does not equal	`3.2 != 2.5`	`True`
<	less than	`10 < 5`	`False`
>	greater than	`10 > 5`	`True`
<=	less than or equal to	`126 <= 100`	`False`
>=	greater than or equal to	`5.0 >= 5.0`	`True`

Misuse of `if`

- What's wrong with the following code?

```
percent = float(input("What percentage did you earn? "))

if percent >= 90:
    print("You got an A!")

if percent >= 80:
    print("You got a B!")

if percent >= 70:
    print("You got a C!")

if percent >= 60:
    print("You got a D!")

if percent < 60:
    print("You got an F!")

...
```



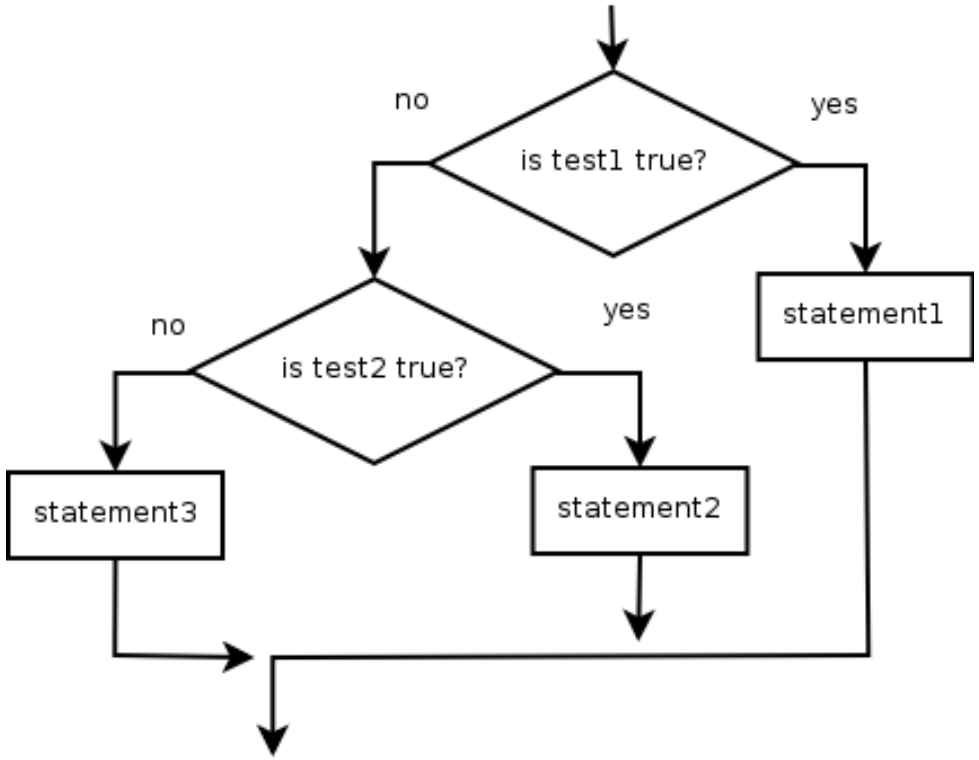
Nested `if/else`

Chooses between outcomes using many tests

```
if test:
    statement(s)
elif test:
    statement(s)
else:
    statement(s)
```

- Example:

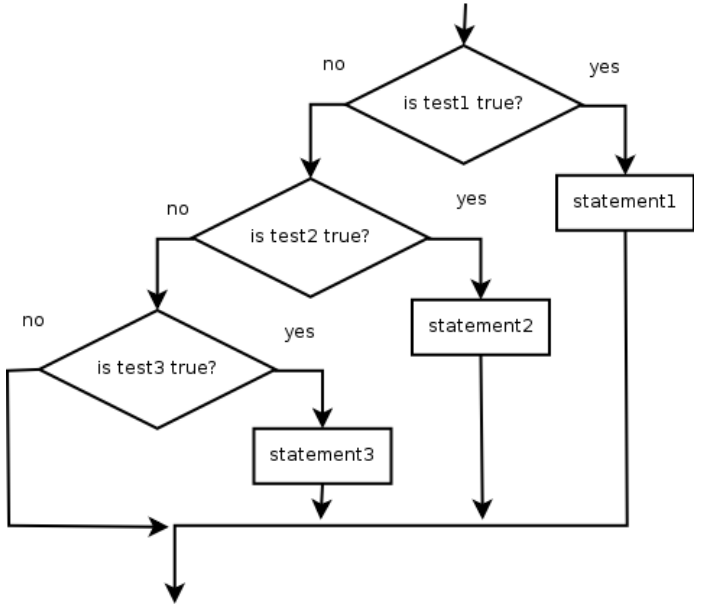
```
if x > 0:
    print("Positive")
elif x < 0:
    print("Negative")
else:
    print("Zero")
```



Nested `if/elif/elif`

- If it ends with `else`, exactly one path must be taken.
- If it ends with `if`, the code might not execute any path.

```
if test:
    statement(s)
elif test:
    statement(s)
elif test:
    statement(s)
```



- Example:

```
if place == 1:
    print("Gold medal!")
elif place == 2:
    print("Silver medal!")
elif place == 3:
    print("Bronze medal.")
```

Nested `if` structures

- exactly 1 path *(mutually exclusive)*

```
if test:
    statement(s)
elif test:
    statement(s)
else:
    statement(s)
```

- 0 or 1 path *(mutually exclusive)*

```
if test:
    statement(s)
elif test:
    statement(s)
elif test:
    statement(s)
```

- 0, 1, or many paths *(independent tests; not exclusive)*

```
if test:
    statement(s)

if test:
    statement(s)

if test:
    statement(s)
```

Which nested `if/else`?

- **(1) if/if/if (2) nested if/else (3) nested if/elif/elif**
  - Whether a user is lower, middle, or upper-class based on income.
    - **(2)** nested `if / elif / else`
  - Whether you made the dean's list (GPA ≥ 3.8) or honor roll (3.5-3.8).
    - **(3)** nested `if / elif`
  - Whether a number is divisible by 2, 3, and/or 5.
    - **(1)** sequential `if / if / if`
  - Computing a grade of A, B, C, D, or F based on a percentage.
    - **(2)** nested `if / elif / elif / elif / else`

Nested `if/else` question

Write a program that produces output like the following:

```
This program reads data for two
people and computes their basal
metabolic rate and burn rate.

Enter next person's information:
height (in inches)? 73.5
weight (in pounds)? 230
age (in years)? 35
gender (male or female)? male

Enter next person's information:
height (in inches)? 71
weight (in pounds)? 220.5
age (in years)? 20
gender (male or female)? female

Person #1 basal metabolic rate = 2042.3
high resting burn rate
Person #2 basal metabolic rate = 1868.4
moderate resting burn rate
```

- Basal Metabolic Rate Formula:

male BMR = 4.54545 x (weight in lb) + 15.875 x (height in inches) - 5 x (age in years) + 5

female BMR = 4.54545 x (weight in lb) + 15.875 x (height in inches) - 5 x (age in years) - 161

BMR	Burn Level
below 12000	low
1200 to 2000	moderate
above 2000	high

Nested `if/else` answer

```
# This program finds the basal metabolic rate (BMR) for two
# individuals. This variation includes several functions
# other than main.

# introduces the program to the user
def give_intro():
    print("This program reads data for two")
    print("people and computes their basal")
    print("metabolic rate and burn rate.")
    print()

# prompts for one person's statistics, returning the BMI
def get_bmr(person):
    print("Enter person", person, "information:")
    height = float(input("height (in inches)? "))
    weight = float(input("weight (in pounds)? "))
    age = float(input("age (in years)? "))
    gender = input("gender (male or female)? ")
    bmr = bmr_for(height, weight, age, gender)
    print()
    return bmr
...
```

Nested `if/else`, cont'd.

```
# this function contains the basal metabolic rate formula for
# converting the given height (in inches), weight
# (in pounds), age (in years) and gender (male or female) into a BMR
def bmr_for(height, weight, age, gender):
    bmr = 4.54545 * weight + 15.875 * height - 5 * age
    if gender.lower() == "male":
        bmr += 5
    else:
        bmr -= 161
    return bmr

# reports the overall bmr values and status
def report_results(bmr1, bmr2):
    print("Person #1 basal metabolic rate =", round(bmr1, 1))
    report_status(bmr1)
    print("Person #2 basal metabolic rate =", round(bmr2, 1))
    report_status(bmr2)

# reports the burn rate for the given BMR value
def report_status(bmr):
    if bmr < 1200:
        print("low resting burn rate");
    elif bmr <= 2000:
        print("moderate resting burn rate")
    else: # bmr1 > 2000
        print("high resting burn rate")

def main():
    give_intro()
    bmr1 = get_bmr(1)
    bmr2 = get_bmr(2)
    print(bmr1, bmr2)
    report_results(bmr1, bmr2)

main()
```