

Introduction to Problem Solving in Python

COSI 10A



Class objectives

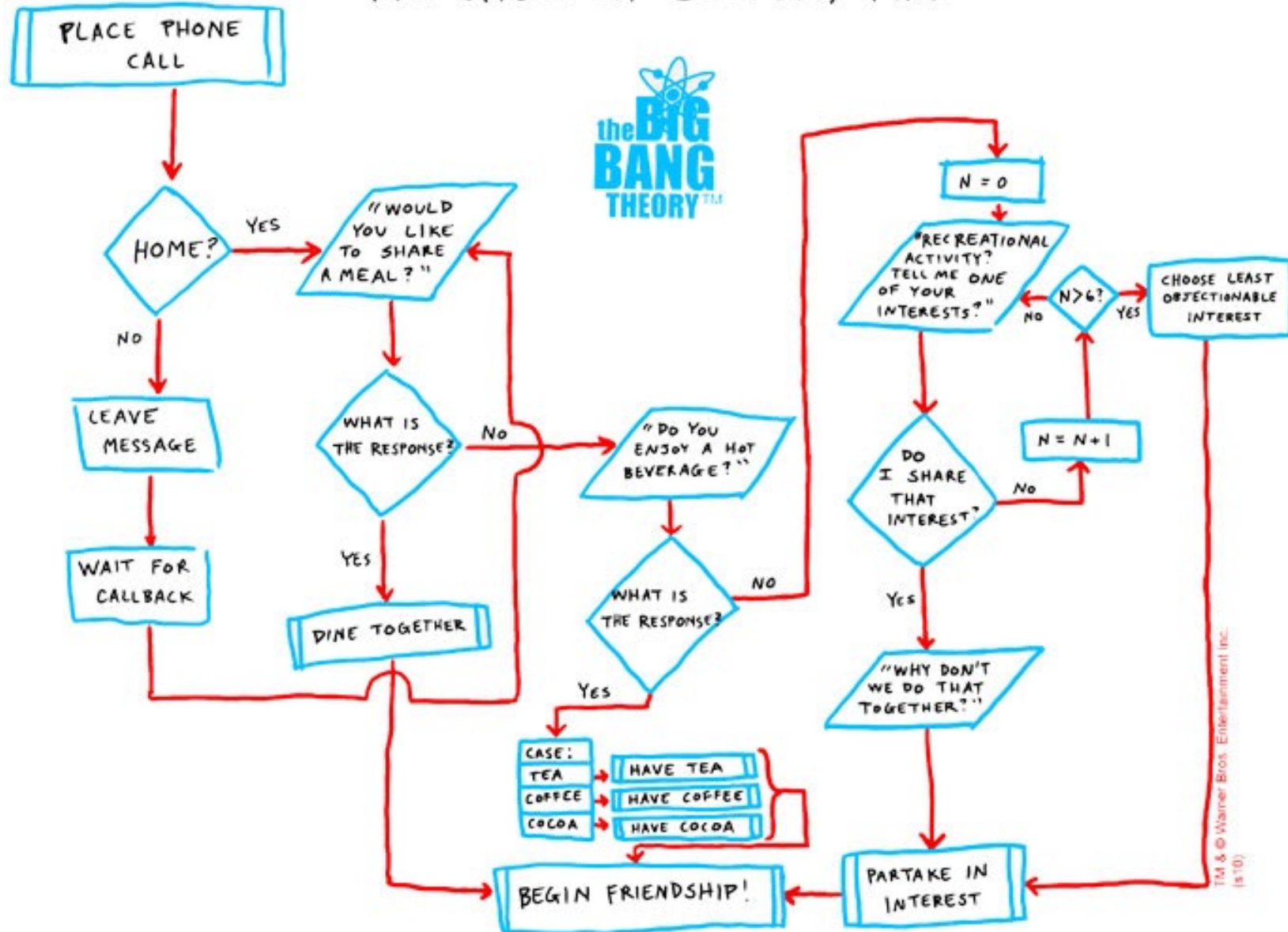
- ❖ Conditional Execution
- ❖ Control structures: If/else statement



Conditional Execution

THE FRIENDSHIP ALGORITHM

DR. SHELDON COOPER, Ph.D





if/else statement

The `if` statement

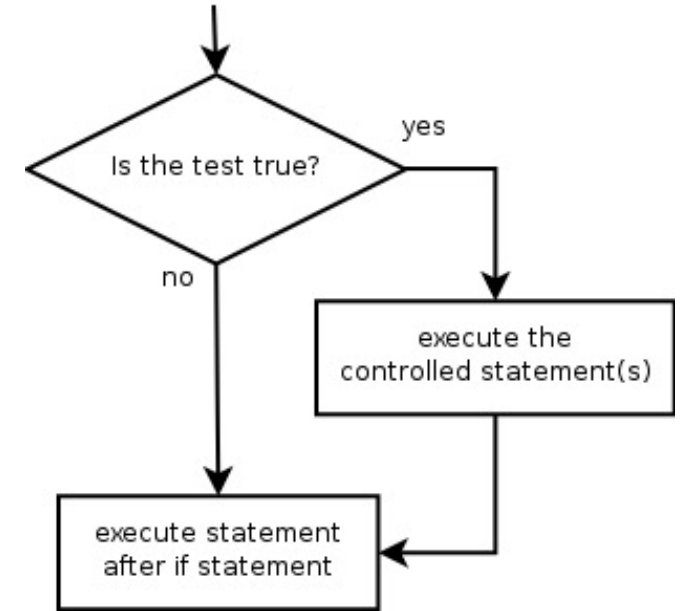
- Executes a block of statements only if a test is true

Syntax:

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

Example:

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



The `if/else` statement

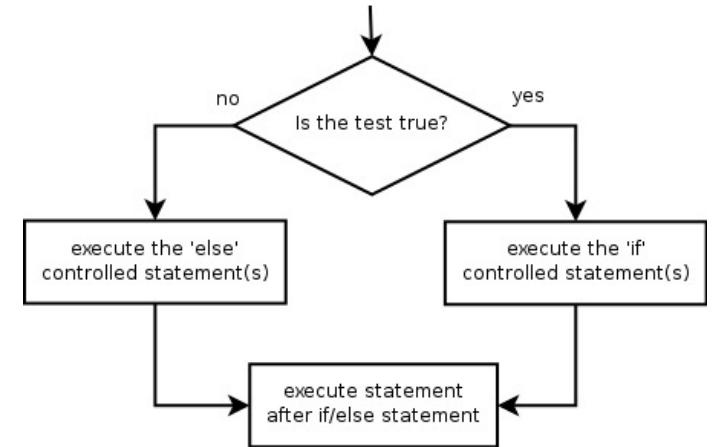
- Executes one block if a test is true, another if false

Syntax:

```
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
- The tests use **relational operators**:

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

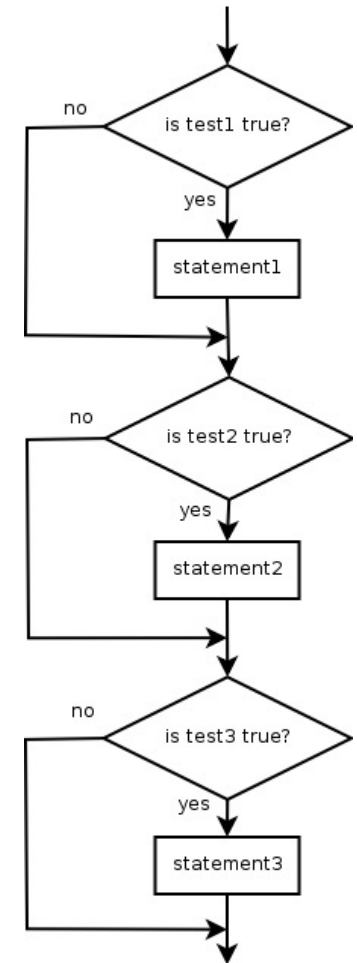
Misuse of if

Is the following code ok?

```
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!")

...
```

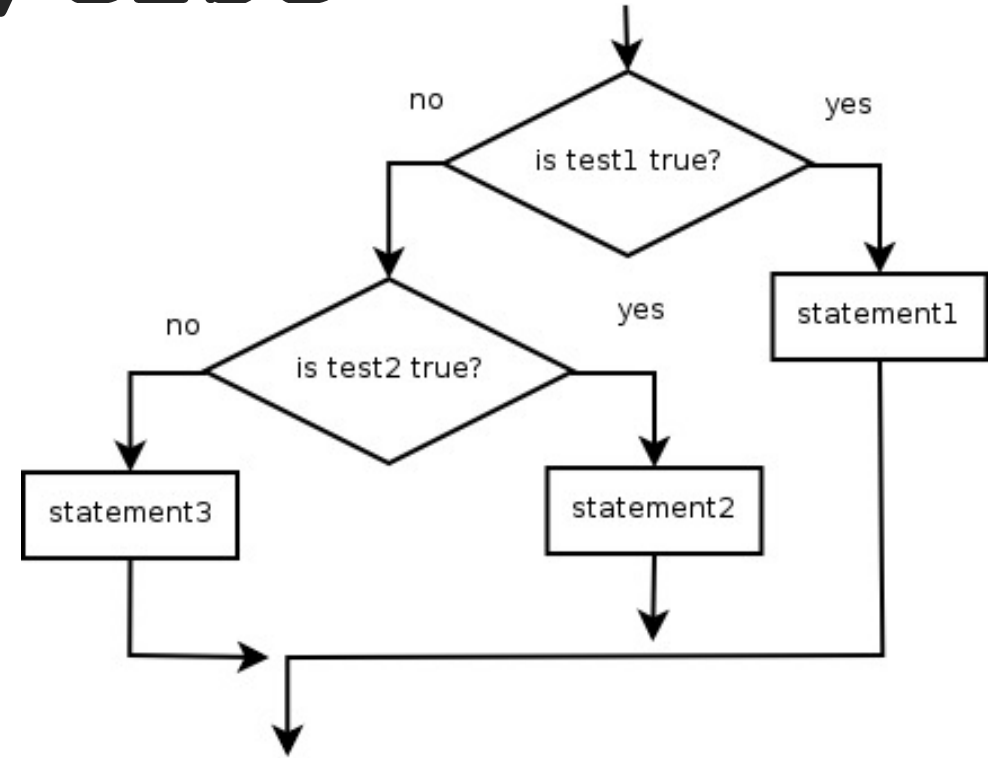


Nested if/elif/else

- Chooses between outcomes using many tests

Syntax:

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



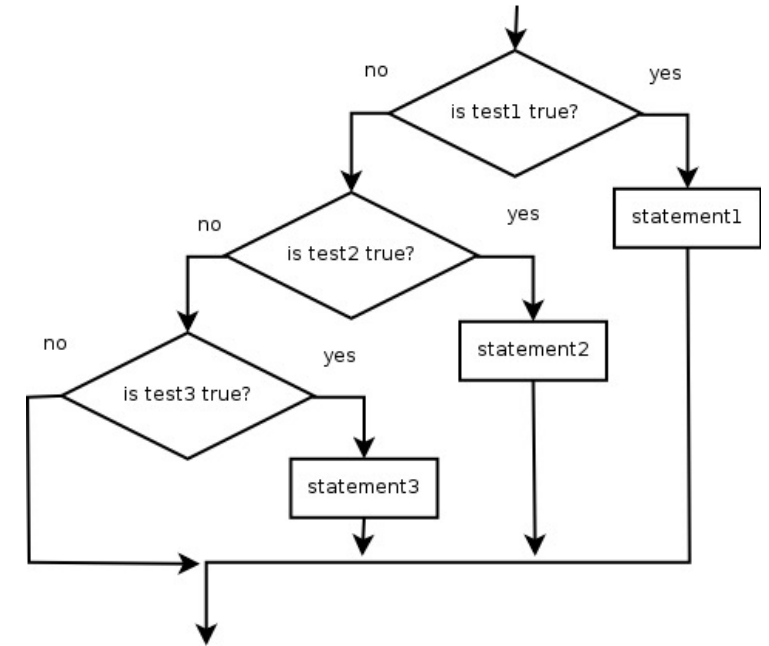
Example:

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

Nested if/elif/elif

Syntax:

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



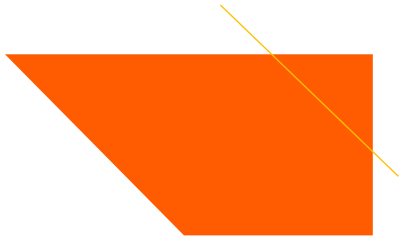
Example:

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



Nested `if` structures

Exactly 1 path	0 or 1 path	0, 1, or many paths
<pre>if test: statement(s) elif test: statement(s) else: statement(s)</pre>	<pre>if test: statement(s) elif test: statement(s) elif test: statement(s)</pre>	<pre>if test: statement(s) if test: statement(s) if test: statement(s)</pre>



Which nested `if/else`?

- Whether you are eating breakfast, lunch, or dinner based on the time of the day
- Whether you made the dean's list ($\text{GPA} \geq 3.8$) or honor roll (3.5-3.8).
- Whether a number is divisible by 2, 3, and/or 5.
- Computing a grade of A, B, C, D, or F based on a percentage.



Which nested `if/else`?

- Whether you are eating breakfast, lunch, or dinner based on the time of the day

nested `if` / `elif` / `else`

- Whether you made the dean's list ($\text{GPA} \geq 3.8$) or honor roll (3.5-3.8).

nested `if` / `elif`

- Whether a number is divisible by 2, 3, and/or 5.

sequential `if` / `if` / `if`

- Computing a grade of A, B, C, D, or F based on a percentage.

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 person's information:

height (in inches)? 73.5

weight (in pounds)? 230

age (in years)? 35

gender (male or female)? male

Enter 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 = $4.54545 \times (\text{weight in lb}) + 15.875 \times (\text{height in inches}) - 5 \times (\text{age in years}) + 5$

female BMR = $4.54545 \times (\text{weight in lb}) + 15.875 \times (\text{height in inches}) - 5 \times (\text{age in years}) - 161$

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



Nested if/else question

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

```
# 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()
```




Nested if/else answer

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
```

```
# 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 answer

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
```

```
# 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 == "male":
        bmr += 5 # bmr = bmr + 5
    else:
        bmr -= 161 # bmr = bmr - 161
    return bmr
```



Nested if/else answer

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

```
# 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)
```

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



Nested if/else answer

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

```
# 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")
```

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



Nested if/else answer

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
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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

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



Trace if/else

```
def if_else_mystery(a, b):  
    if a * 2 < b:  
        a = a * 3  
    elif a > b:  
        b = b + 3  
    if b < a:  
        b = b + 1  
    else:  
        a = a - 1  
    print(a, b)
```

if_else_mystery(10, 2)

if_else_mystery(3, 8)

if_else_mystery(10, 30)

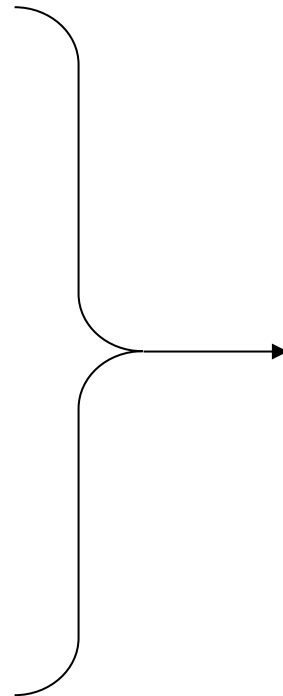


Factoring if/else answer

Factoring means extracting common/redundant code

Example:

```
if a == 1:
    print(a)
    x = 3
    b = b + x
elif a == 2:
    print(a)
    x = 6
    y = y + 10
    b = b + x
else:      # a == 3
    print(a)
    x = 9
    b = b + x
```



```
print(a)
x = 3 * a
if a == 2:
    y = y + 10
b = b + x
```