


Objectives

- Conditional statements

Review

- What makes a function “good”?
- How do we typically use a function that returns something?

Parts of an Algorithm

- Input, Output
 - Primitive operations
 - What data you have, what you can do to the data
 - Naming
 - Identify things we're using
 - Sequence of operations
 - Conditionals
 - Handle special cases
 - Repetition/Loops
 - Subroutines
 - Call, reuse similar techniques
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Making Decisions

- Sometimes, we do things only if some condition holds (i.e., “is true”)
- Examples
 - If the PB is new (has a safety seal)
 - Then, I will take off the safety seal
 - If it is raining and it is cold
 - Then, I will wear a raincoat
 - If it is Saturday or it is Sunday
 - Then, I will wake up at 9 a.m.
 - Otherwise, I wake up at 7 a.m.
 - If the shirt is purple or the shirt is on sale and blue
 - Then, I will buy the shirt

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Conditionals

- Sometimes, we only want to execute a statement in certain cases
 - Example: Finding the absolute value of a number
 - $|4| = 4$
 - $|-10| = 10$
 - To get the answer, we multiply the number by -1 *only if it's a negative number*
 - Code:

```
if x < 0 :  
    abs = x*-1
```

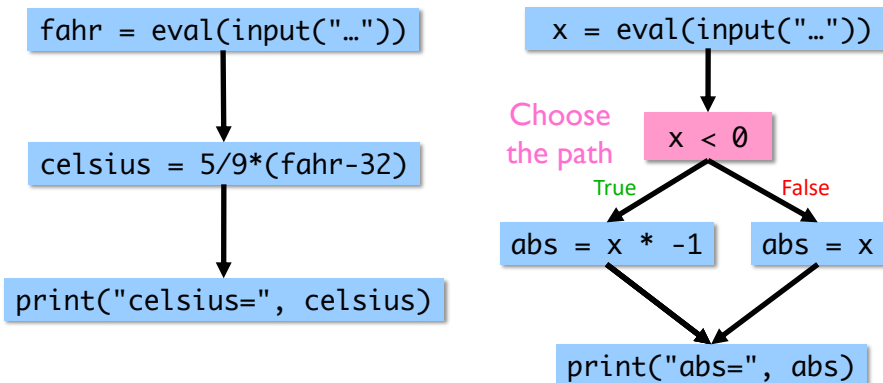
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if Statements

- Change the *control flow* of the program



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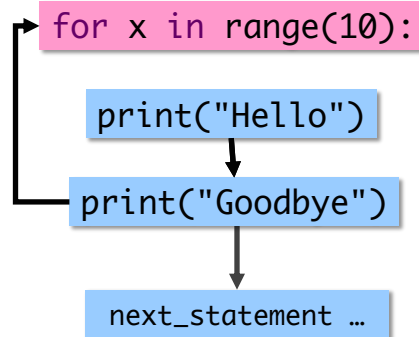
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Other Constructs That Change Control Flow

- **for** loops

- Repeats a loop body a fixed number of times before going to the next statement after the **for** loop

```
for x in range(10):  
    print("Hello")  
    print("Goodbye")  
next_statement ...
```



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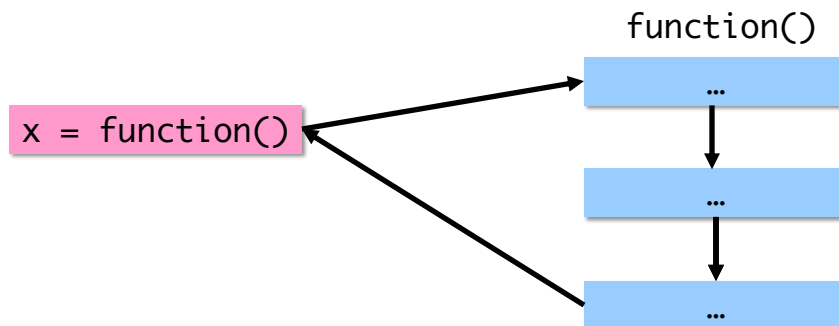
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Other Constructs That Change Control Flow

- Function calls

- “Go execute some other code and then come back with the result”



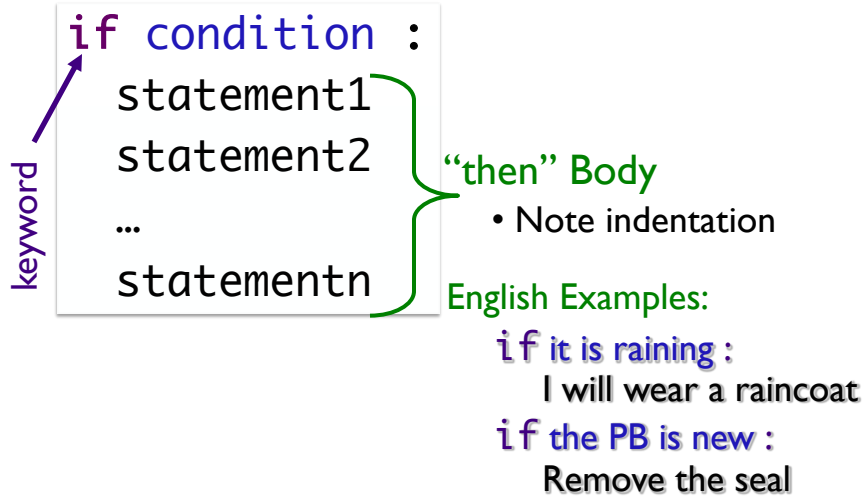
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Syntax of **if** statement:

Simple Decision



The diagram illustrates the syntax of a simple decision **if** statement. It shows the keyword **if** followed by a condition, a colon, and then a block of statements (statement1, statement2, ..., statementn) indented. A purple arrow points to the **if** keyword, labeled "keyword". A green bracket groups the indented statements, labeled "'then' Body". To the right of the bracket, a bullet point says "• Note indentation". Below this, under the heading "English Examples:", two examples are provided: **if** it is raining : followed by "I will wear a raincoat", and **if** the PB is new : followed by "Remove the seal".

```
if condition :  
    statement1  
    statement2  
    ...  
    statementn
```

“then” Body

- Note indentation

English Examples:

```
if it is raining :  
    I will wear a raincoat  
if the PB is new :  
    Remove the seal
```

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Conditions

- Syntax (typical, others later):
 - **<expr> <relational_operator> <expr>**
- Evaluates to either **True** or **False**
 - **Boolean type**

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Relational Operators

- Syntax:
 - `<expr> <relational_operator> <expr>`
- Evaluates to either True or False
 - Boolean type

Low precedence
After arithmetic operators

Relational Operator	Meaning
<	Less than?
<=	Less than or equal to?
>	Greater than?
>=	Greater than or equal to?
==	Equals?
!=	Not equals?

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Use Python interpreter

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Examples: Using Conditionals

- Determine if a number is even or odd

```
x = eval(input("Enter a number: "))
remainder = x % 2
if remainder == 0 :
    print(x, "is even")
if remainder == 1:
    print(x, "is odd")
```

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evenorodd.py

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Common Mistake: Assignment Operator vs. Equality Operator

- Assignment operator: `=`
- Equality operator: `==`

```
x = eval(input("Enter a number: "))
remainder = x%2
if remainder = 0 :
    print(x, "is even. ")
```

Syntax error (pointing to the assignment operator in the if statement)

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Syntax of `if` statement:

Two-Way Decision

English Example:

keywords (pointing to `if` and `else`)

```
if condition :
    statement1
    statement2
    ...
    statementn
else :
    statement1
    statement2
    ...
    statementn
```

"then" Body (pointing to the first block of statements)

"else" Body (pointing to the second block of statements)

```
if it is Saturday or it is Sunday :
    I wake up at 9 a.m.
else :
    I wake up at 7 a.m.
```

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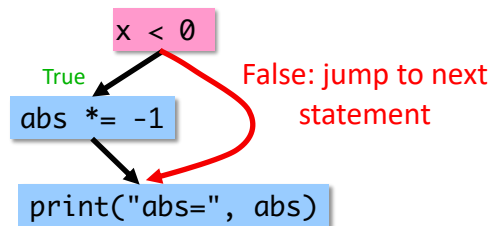
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If-Else statements (absolute values)

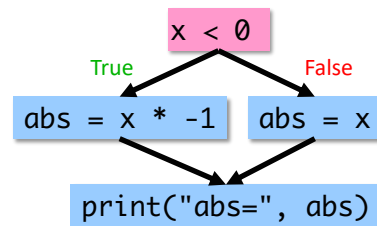
```
abs = x
if x < 0 :
    abs *= -1
print("abs=", abs)
```

If statement



```
if x < 0 :
    abs = x * -1
else:
    abs = x
print("abs=", abs)
```

If-else statement



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Examples: Using Conditionals

- Determine if a number is even or odd
- More efficient implementation
 - Don't need to check if remainder is 1 because if it's not 0, it *must* be 1

```
x = eval(input("Enter a number: "))
remainder = x % 2
if remainder == 0:
    print(x, "is even")
else:
    print(x, "is odd")
```

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Practice: Draw the Flow Chart

```
print("This program determines your birth year")
print("given your age and current year")
print()
age = eval(input("Enter your age: "))

if age > 120:
    print("Don't be ridiculous, you can't be that old.")
else:
    currentYear = eval(input("Enter the current year: "))
    birthyear = currentYear - age
    print()
    print("You were either born in", birthyear, end='')
    print("or", birthyear-1)
print("Thank you. Come again.")
```

What does this code do?

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Flow of Control: Using **return**

Is this implementation of
the function correct?

```
def max(num1, num2):
    if num1 >= num2:
        return num1
    else:
        return num2
```

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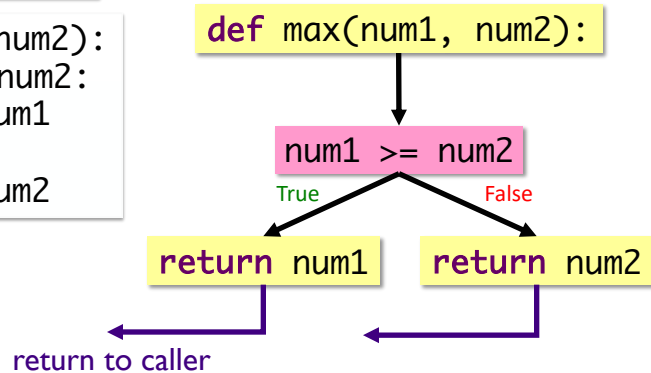
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Flow of Control: Using **return**

Is this implementation of the function correct?

```
def max(num1, num2):  
    if num1 >= num2:  
        return num1  
    else:  
        return num2
```



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Flow of Control: Using **return**

Is this implementation of the function correct?

```
def max(num1, num2):  
    if num1 >= num2:  
        return num1  
    return num2
```

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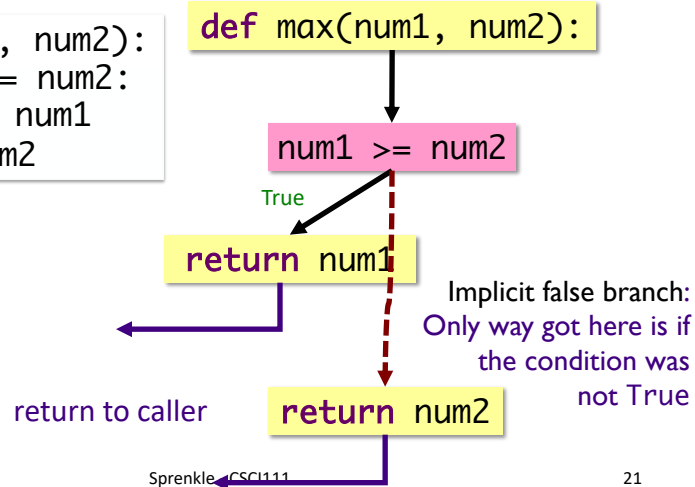
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Flow of Control: Using **return**

Is this implementation of the function correct?

```
def max(num1, num2):  
    if num1 >= num2:  
        return num1  
    return num2
```



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Practice: Speeding Ticket Fines

- Any speed clocked over the limit results in a fine of at least \$50, plus \$5 for each mph over the limit, plus a penalty of \$200 for any speed over 90mph.
- Our function
 - Input: speed limit and the clocked speed
 - Output: the appropriate fine
 - What should the appropriate fine be if the user is not speeding?

`speedingticket.py`

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Development Process

1. Create test cases

- Known as test-driven development (TDD)
- Idea: Focus on the outcomes first
- Helps you think about the problem without thinking about the code itself

2. Define function

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Example Test Cases

Speed limit	Clocked speed	Expected (fine)
25	26	55
30	32	60
50	65	125
70	95	375
20	15	0
90	91	255
91	91	0

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Looking Ahead

- Exam
 - Your Questions