

Objectives

- More on conditionals
- Boolean operators
- **sys** module

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BI Review

- <https://www.google.com/settings/ads/onweb/>
 - Make the ads you see on the web more interesting
 - Many websites, such as news sites and blogs, partner with us to show ads to their visitors. To see ads that are more related to you and your interests, edit the categories below, which are based on sites you have recently visited.
 - Your interests are associated with an **advertising cookie** that's stored in your browser. If you don't want us to store your interests, you can opt out below. Your ads preferences only apply in this browser on this computer. They are reset if you delete your browser's cookies.

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Review

- How can we make Python code execute only under certain circumstances?
- How do we say "otherwise" in Python?

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Review: Syntax of **if** statement: Simple Decision

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

keyword

"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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Syntax of **if** statement: Two-Way Decision

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

keywords

English Example:

```
if it is Saturday or Sunday :  
    I wake up at 10 a.m.  
else :  
    I wake up at 7 a.m.
```

"then" Body

"else" Body

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Review: Relational Operators

- Syntax:
 - `<expr> <relational_operator> <expr>`

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

Low precedence

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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 7

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")
```

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

Why is this a more efficient implementation?

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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

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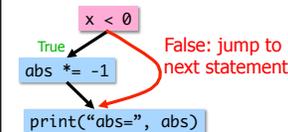
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If-Else statements (absolute values)

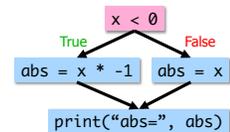
```
abs=x
if x < 0 :
    abs *= -1
print("abs=", abs)
```

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

If statement



If-else statement



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Review: 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 program
 - Input: speed limit and the clocked speed
 - Output: either (a) that the clocked speed was under the limit or (b) the appropriate fine

What does the control flow diagram look like?

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speedingticket.py 11

Practice: Numeric to Letter Grade

- Determine a numeric grade's letter grade (A, B, C, D, or F)

Numeric Grade	Letter Grade
90 and above	A
80 to below 90	B
70 to below 80	C
60 to below 70	D
Below 60	F

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Syntax of if statement: Multi-Way Decision

```

if condition :
    <then-body1>
elif condition :
    <then-body2>
elif condition :
    <then-body3>
    ...
else:
    <default-body>
    
```

English Example:

```

if it is Saturday:
    I wake up at 10 a.m.
elif it is Sunday:
    I wake up at 9 a.m.
else:
    I wake up at 7 a.m.
    
```

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Using the building blocks: Nesting if-else statements

```

if condition :
    if condition :
        statements
    else:
        statements
else:
    statements
    
```

if-else statement is nested inside the if

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Using the building blocks: Nesting if-else statements

```

if condition :
    statements
else:
    if condition :
        statements
    else :
        statements
    
```

if-else statement is nested inside the else

This structure can be rewritten as an if-elif-else statement

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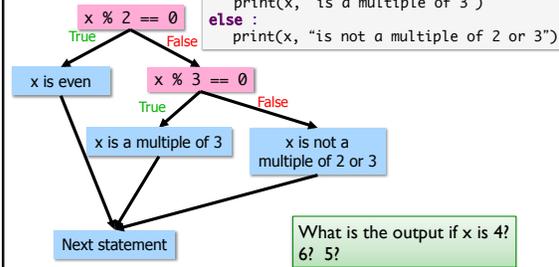
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If-Else-If statements

```

if x % 2 == 0 :
    print(x, "is a multiple of 2")
elif x % 3 == 0 :
    print(x, "is a multiple of 3")
else :
    print(x, "is not a multiple of 2 or 3")
    
```



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Modify to use elif

- Determine if a numeric grade is a letter grade (A, B, C, D, or F)

Numeric Grade	Letter Grade
90 and above	A
80 to below 90	B
70 to below 80	C
60 to below 70	D
Below 60	F

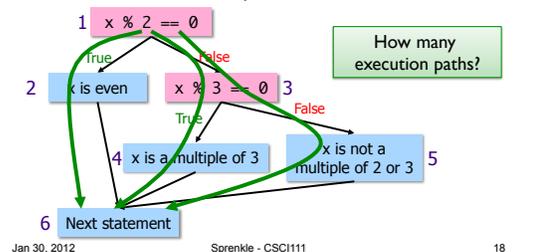
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Testing with If Statements

- Make sure have test cases that execute each branch in control flow diagram
 - > i.e., Each execution path is "covered"



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Review: 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 program
 - Input: speed limit and the clocked speed
 - Output: either (a) that the clocked speed was under the limit or (b) the appropriate fine

What should our test cases be?

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More Complex Conditions

- Boolean
 - Two logical values: True and False
- Combine conditions with Boolean operators
 - and** – True only if **both** operands are True
 - or** – True if **at least one** operand is True
 - not** – True if the operand is not True
- English examples
 - If it is raining **and** it is cold
 - If it is Saturday **or** it is Sunday
 - If the shirt is on sale **or** the shirt is purple

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Truth Tables

operands

A	B	A and B	A or B	not A	not B	not A and B	A or not B
T	T						
T	F						
F	T						
F	F						

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Truth Tables

operands

A	B	A and B	A or B	not A	not B	not A and B	A or not B
T	T	T	T	F	F	F	T
T	F	F	T	F	T	F	T
F	T	F	T	T	F	T	F
F	F	F	F	T	T	F	T

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What is the output?

```
x = 2
y = 3
z = 4
```

```
b = x==2
c = not b
d = (y<4) and (z<3)
print("d=", d)
d = (y<4) or (z<3)
print("d=", d)
```

```
d = not d
print(b, c, d)
```

Because of precedence, we don't need parentheses

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Practice: Numeric Grade Input Range

- Enforce that user must input a numeric grade between 0 and 100
 - In Python, we can't (always) write a condition like `0 <= num_grade <= 100`, so we need to break it into two conditions
- Write an appropriate condition for this check on the numeric grade
 - Using **and**
 - Using **or**

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Practice: Numeric Grade Input Range

- Enforce that user must input a numeric grade between 0 and 100

➤ Using **and**

```
if num_grade >= 0 and num_grade <= 100:  
    computation  
else:  
    print error message
```

➤ Using **or**

```
if num_grade < 0 or num_grade > 100:  
    print error message  
else:  
    computation
```

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Short-circuit Evaluation

- Don't necessarily need to evaluate all expressions in a compound expression
- **A and B**
 - If A is **False**, compound expression is **False**
- **A or B**
 - If A is **True**, compound expression is **True**
- No need to evaluate B
 - Put more important/limiting expression first
 - Example: `if count != 0 and sum/count > 10:
 do something`

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SYS MODULE

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sys module

- Has useful "system" functions
- Use the **exit([status])** function
 - **Exits the whole program**
 - If status is empty, defaults to 0
 - Status of 0 means success
 - Other values are various failures
- *Another example of changing control flow*

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Example Use of sys module

```
import sys  
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.")  
    sys.exit(1) ← Ejector seat  
  
# input is reasonable ...  
currentYear = eval(input("Enter the current year: "))  
birthyear = currentYear - age  
print()  
print("You were either born in", birthyear, end='')  
print("or", birthyear-1)
```

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Announcements

- Lab tomorrow
 - Think about the picture you're going to draw
 - Due Friday
- Friday: DARPA Urban Challenge
- Extra Credit Opportunities
 - Reading articles, summarized on Sakai
 - Upcoming talks

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