

Objectives

- More on conditionals

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Review: Broader Issues

- Goal: Give you the big picture
 - Day-to-day: easy to get lost in the minutia
- Relation to class: the “small” things we’re doing in class can be put together to do bigger things!
- On the worm: If I were to write a worm that detects illegally downloaded movies and music, how many “hits” would I get on your computers?

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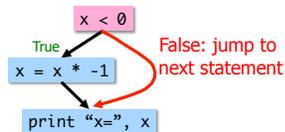
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Review: if, if-else Statements

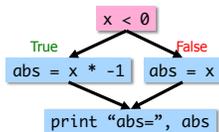
```
if x < 0 :  
    x *= -1  
print "abs=", x
```

If statement



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

If-else statement



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Review: Relational Operators

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

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

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

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Where We Left Off

```
speedlimit = input("What was the speed limit? ")  
clockedspeed = input("What was your speed? ")  
  
if clockedspeed <= speedlimit:  
    # not speeding  
    print "You were not speeding."  
    print "Continue safe driving practices."  
else:  
    # TODO: calculate the fine  
    fine = 0  
    print "Your fine is $%.2f." % fine
```

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Modify: Check for Other Bad Input

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

if age > 110:
    print "Don't be ridiculous, you can't be that old."
else:
    currentYear = input("Enter the current year >> ")
    birthyear = currentYear - age
    print
    print "You were either born in", birthyear, "or",
    print birthyear-1
```

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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>
```

keywords

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

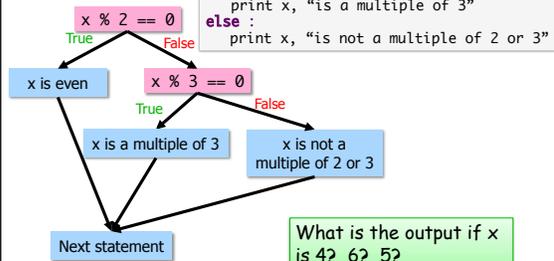
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If-Else-If statements

```
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

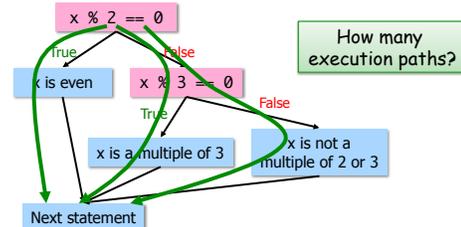
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Testing with If Statements

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



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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 = (y<4) or (z<3)
print d
```

Because of precedence, we don't need parentheses

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

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eval_cond.py

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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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Extra Credit Opportunity

- **Talk: "A Mathematician's Year on Capitol Hill"**
- Katherine Crowley, W&L Mathematics Department
- Time: Wednesday, February 3, 3:30 p.m.
- Place: Robinson Hall, Room 6
- 10 points towards lab grade

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Announcements

- Lab tomorrow
 - Due Friday
- Exam on Friday
 - Prep document on course web site

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