

## Objectives

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

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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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## Review: Relational Operators

- Syntax:  
    > <expr> <relational\_operator> <expr>

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

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## Examples: Using Conditionals

- Determine if a number is even or odd

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

Syntax error

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

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

keywords

“then” Body  
“else” Body

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

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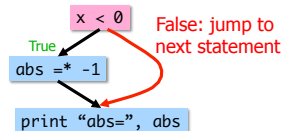
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## If-Else statements (absolute values)

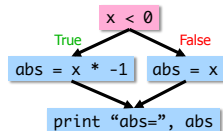
```
abs=x
if x < 0 :
    abs *= -1
print "abs=", abs
```

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

### If statement



### 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 = 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 = 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: 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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## 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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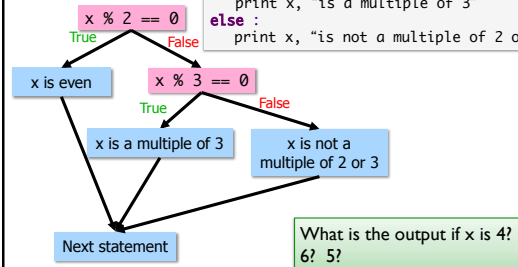
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## If-Else-If statements

```

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

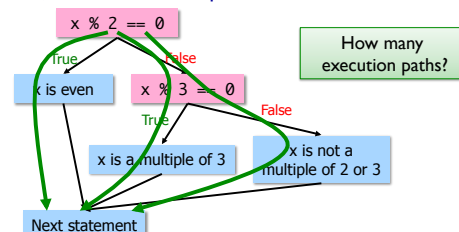
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## Testing with If Statements

- 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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## Enhanced Lottery Game

- Check if user's pick matches the number you generated

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[pick4winner.py](#)

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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 = input("Enter your age >> ")
if age > 120:
    print "Don't be ridiculous. You can't be that old!"
    sys.exit(1)
# input is reasonable ...
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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## Announcements

- Lab tomorrow
  - Due Friday
- Friday: DARPA Urban Challenge
- Extra Credit Opportunities
  - Reading articles, summarized on Sakai
  - Jeopardy! game – see questions on Sakai forum
  - Upcoming talks

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## Convert the Code to if-elif-else

```
clockspeed = input("Enter the clocked speed: ")
speedlimit = input("Enter the speed limit: ")

if clockspeed <= speedlimit:
    print "Continue safe driving practices"
else:
    diff = clockspeed - speedlimit
    fine = 50 + 5 * diff
    if clockspeed > 90:
        fine += 200
    print "Slow down! You've been fined $" + str(fine) + "."
```

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## Convert the Code to if-elif-else

```
clockspeed = input("Enter the clocked speed: ")
speedlimit = input("Enter the speed limit: ")

if clockspeed <= speedlimit:
    print "Continue safe driving practices"
elif clockspeed < 90:
    diff = clockspeed - speedlimit
    fine = 50 + 5 * diff
    print "Slow down! You've been fined $" + str(fine) + " ."
else:
    diff = clockspeed - speedlimit
    fine = 250 + 5 * diff
    print "Slow down! You've been fined $" + str(fine) + " ."
```

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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!

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