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Software Development Process

- Figure out the problem - for simple problems - think about how you would do the problem by hand
- Determine the specifications - for a first programming course - the specifications are generally in the assignment handout
Software Development

• Create a Design - In the beginning this is an outline of the major steps

• Implement the design - build your software

• Test and debug the program - make sure to think about different things which might go wrong

• Maintain the program
def main():

celsius = input("What is the Celsius temperature? ")
fahrenheit = (9.0 / 5.0) * celsius + 32
print "The temperature is", fahrenheit, "degrees Fahrenheit."

main()
Running the Program...

$ python convert.py

What is the Celsius temperature? 0
The temperature is 32.0 degrees Fahrenheit.

$ python convert.py
What is the Celsius temperature? 100
The temperature is 212.0 degrees Fahrenheit.
Variable Names / Identifiers

- Must start with a letter or underscore _
- Must consist of letters and numbers
- Case Sensitive
- Good: spam eggs spam23
- Bad: 23spam #sign var.12
- Different: spam Spam SPAM
Reserved Words

- You can not use reserved words as variable names / identifiers

and del for is raise assert elif from lambda return break else global not try class except if or while continue exec import pass yield def finally in print
Expressions

• Programming languages have lots of expressions
• Expressions are things that can be evaluated to a value
• Can be a string, number or virtually anything
• Can be a single value or computed from several values using operators
celsius = input("What is the Celsius temperature? ")

fahrenheit = (9.0 / 5.0) * celsius + 32

print "The temperature is", fahrenheit, "degrees Fahrenheit."
Expressions with Numbers

- Look up variables
- Do math operations in order left to right
  - ( )
  - * /
  - + -

\[ 3.9 \times x \times (1 - x) \]

Result: 0.93
Expressions With Strings

- For strings the `+` operator means “concatenate”

```
Hello "there " + abc
```

```
"Hello " + "there " + abc
```

```
"Hello there Bob"
```

```
abc "Bob"
```

"Bob"
Output Statements

• The print statement takes one or more expressions separated by commas and prints the expressions on the output separated by spaces.

x = 6
print 2  →  2
print 2 + 3  →  5
print “Hello”, 4+5  →  Hello 9
Assignment Statements

• variable = expression

• Evaluate the expression to a value and then put that value into the variable

```
x = 1
spam = 2 + 3
spam = x + 1
x = x + 1
```
Slow Motion Assignment

• We can use the same variable on the left and right side of an assignment statement

• Remember that the right side is evaluated *before* the variable is updated

```
Before                                   After
x = 10                                     x = 11
x = x + 1
```
Input Statements

- `input("Prompt")` - displays the prompt and waits for us to input an expression - this works for numbers.

- In Chapter 4 we will see how to read strings.

```python
>>> x = input("Enter ")
Enter 123
>>> print x
123
```
Simultaneous Assignment

• variable, variable = expression, expression

• Both expressions on right hand side are evaluated before the right hand side variables are updated

```python
>>> x = 1
>>> y = 2
>>> x, y = y, x
>>> print x, y
2 1
>>> x, spam = 2 + 3, "hello"
```
Definite Loops
Definite Loops

- Loops that run a fixed (aka **definite**) number of times
- Loops that “iterate” through an ordered set
- Loops that run “for” a number of times

```python
for abc in range(5):
    print "Hi"
    print abc
```

```
Hi
0
Hi 1
Hi 2
Hi 3
Hi 4
```
Definite Loops

- Loops that run a fixed (aka **definite**) number of times
- Loops that “iterate” through an ordered set
- Loops that run “for” a number of times
- The **iteration variable** changes for each iteration of the loop

```python
for abc in range(5):
    print "Hi"
    print abc
```

```
Hi
0
Hi 1
Hi 2
Hi 3
Hi 4
```

Colon (:) defines the start of a block. Indenting determines which lines belong to the block.
Looking at In...

- The iteration variable "iterates" though the sequence (ordered set)
- The block (body) of code is executed once for each value in the sequence
- The iteration variable moves through all of the values in the sequence

```python
for abc in range(5):
    ... block of code ...
```

Five-element sequence:

```
[0, 1, 2, 3, 4]
```
In a FlowChart

- The iteration variable "iterates" though the sequence (ordered set)
- The block (body) of code is executed once for each value in the sequence
- The iteration variable moves through all of the values in the sequence
Program:

for i in range(4) :
    print i

Loop body is run repeatedly
What is `range(10)`?

- `range(10)` is a built-in function that returns a sequence of numbers.
- The `for` statement can iterate through any sequence.
- A sequence can have values of different types.

```python
>>> range(10)
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
>>> for i in [0, 1, 2]:
...     print(i)
...
0
1
2
>>> for i in [0, "abc", 9, 2, 3.6]:
...     print(i)
...
0
abc
9
2
3.6
```
Summary

- Software Development
- Input Processing Output Pattern
- Variable Names / Identifiers
  - What are legal identifiers
  - Which identifiers are unique
- Reserved Words
- Expressions
- Output Statements
- Assignment Statements
- Input Statements
- Simultaneous Assignments
- Definite Loops
- Sequences