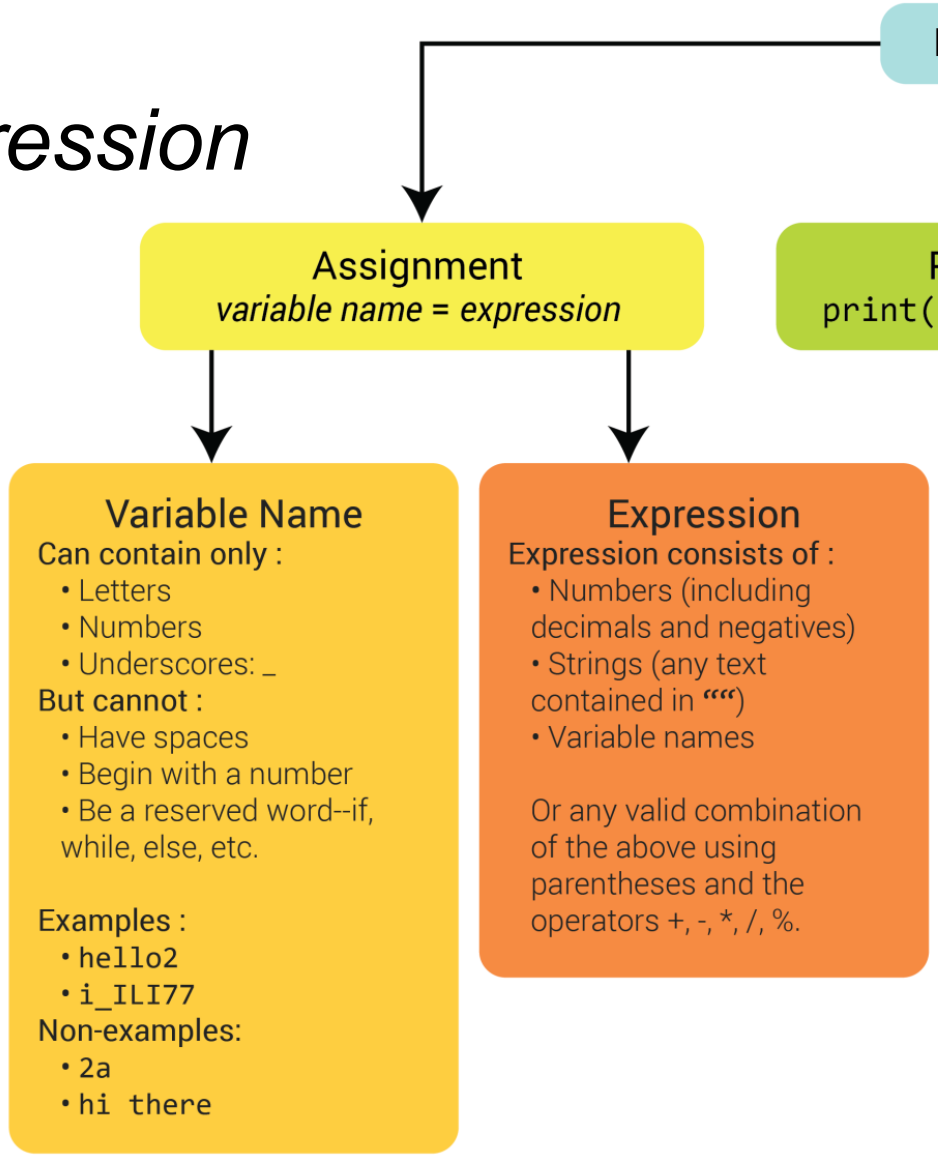
Python syntax and semantics

- Definitions
- Example programs
- If we have time, we'll design one instruction of an ISA ☺
- Homeworks can be collected at end of class

Assignments

- *variable name = expression*
  - x = 2
  - x = 7 * x
  - x = 3 * x + x



Illegal variable names

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

Expression

- Valid expressions
  - `x = 4`
  - `y = x + 1`
  - `x = 2`
  - `x = 5*x + 2*(3 - y)`
- **NOT VALID**
  - “`Hello`” `+ 2`
  - "hello" * "aerodrome"

String concatenation

- Valid *addition* of strings
  - “`hello`” + “`world`”

Strings

- Things within “ “
- Use \” to represent quotation marks itself
- \n represents a new line (also called line-break)

If/else

```
if(test):
    indented lines
else:
    indented lines
```

- Else is optional

tests

- *expression comparison expression*
  - x == "hello"
  - 2*x > 5
  - x+y != z

Comparison operator	Meaning
<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to
==	Equal to
!=	Not equal to

What does this do?

```
if(1 == 1):
  print("hello")
else:
  print("something is wrong with the
  universe")
```

while

```
while(test):
   lines that you want to run for
as long as the test holds true
```

(the test is re-run every time we get to the end of the indented lines)

Example

```
counter = 0
while(counter < 3):
    print(":)")
    counter = counter + 1
print(":/")
```

		Variables after current line runs	Output so far
counter = 0	It was the next line	counter = 0	
while(counter < 3):	It was the next line	counter = 0	
print(":)")	counter was < 3	counter = 0	:)
counter = counter + 1	It was the next line	counter = 1	:)
print(":)")	We reached the end of the while block, but counter was < 3, so we go back to the start	counter = 1	:) :)
counter = counter + 1	It was the next line	counter = 2	:) :)
print(":)")	We reached the end of the while block, but counter was < 3, so we go back to the start	counter = 2	:) :) :)
counter = counter + 1	It was the next line	counter = 3	:) :) :)
print(":/")	counter was not < 3	counter = 3	:) :) :) :/

Comments

this is a comment

Begin line with **#**

Factorial (ver 1)

```
print(1*2*3*4*5*6*7*8*9*10)
```

Factorial (ver 2)

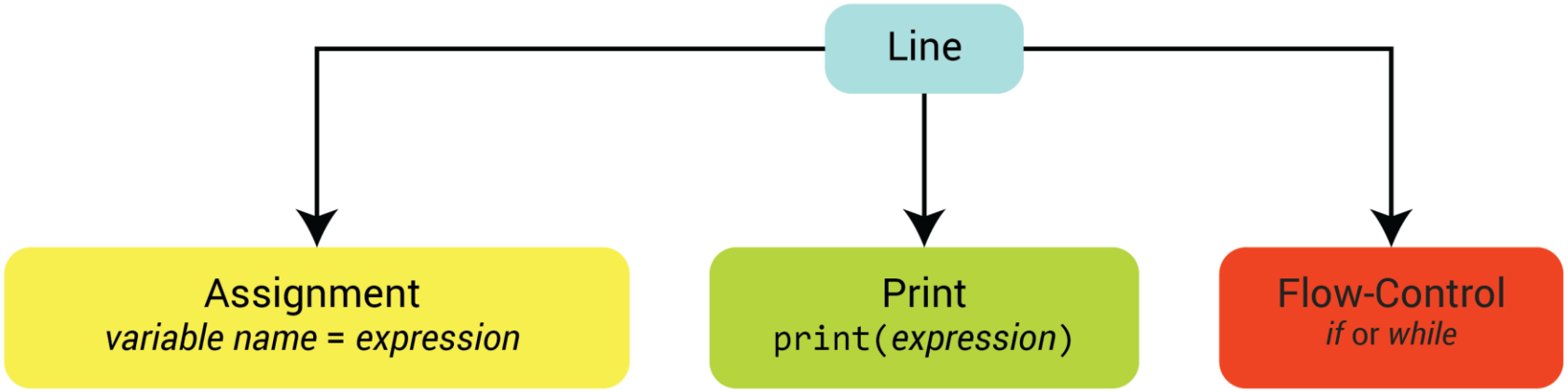
- Step 1: Store the number whose factorial we want in a variable called input.
- Step 2: Store the number 1 in the variable answer.
- Step 3: Store the number 2 in the variable counter.
- Step 4: Repeat the following until counter is greater than input:
  - Substep 1: Replace answer with answer * counter
  - Substep 2: Increment counter by 1
- Step 5: print the number stored in the variable answer.

Factorial (Ver 2)

```
input = 10
answer = 1
counter = 2
while(counter < input):
    answer = answer * counter
    counter = counter + 1
print(answer)
```

Summary

- Programs execute one line at a time



Next Class

- Read 2.5 through 2.6
- Look at the Online HW system

CS/ECE 252 Lecture 5: Programming, Python Syntax; 2015 September 14

Announcements

Homework 1 can be collected at end of class.
Only half of the problems of the homework will be graded.
Should have finished reading chapter 2.4.

Python Syntax and Definitions

- Assignments
  - variable_name = expression
  - Examples:
    ```
    x = 2
    x = 7 * x
    x = 3 * x + x
    ```
  - variable_names
    - can only contain letters, numbers, and underscores
    - cannot begin with a number nor be a reserved word (e.g. if, while, else)
- Illegal variable names
  - as, assert, break, class, continue, def, del, elif, else, except, exec, finally, for, and etc.
- Expressions
  - variable_name combined with arithmetic operation
  - Examples
    ```
    x = 4
    y = x + 1
    x = 2
    x = 5 * x + 2 * (3 - y)
    ```
  - Not valid
    - "hello" + 2
    - "hello" * "aerodrome"
  - String concatenation is valid
    - "hello" + "world"
- Strings
  - Things within ""
  - Use \" to represent quotation marks itself
  - Use \n to represent a new line AKA line break
  - Use \\ to represent a backslash
- If/else
  ```
  if(test):
      indented lines
  else:
      indented lines
  ```
  - Else is optional
- Tests
  - Expression comparison expression
  - Example tests
    - x == "hello"
    - 2 * x > 5
    - x + y != z
  - Example operators
    - <, >, <=, >=, ==, !=

while

```
while(test):
    lines that you want to run while the test holds true
```

The rest is re-run every time we get to the end of the indented lines

Comments

```
# this is a comment
```

Comments begin with #

Example Programs

Example 1

```
if(1==1):
    print("hello")
else:
    print("something is wrong with the universe")
```

This will print "hello"

Example 2

```
counter = 0
while(counter < 3):
    print(":)")
    counter = counter + 1
print(":/")
```

Current line	**Why we went to this line**	**Variables after line runes**	**Output so far**
counter = 0	it was the first/next line	counter = 0	
while(counter < 3):			
print(":)")	counter < 3		:)
counter = counter + 1		counter = 1	:)
print(":)")			:) :)
…			
print(":/")	broke out of while loop because counter not less than 3	counter = 3	:) :) :) :/

Example 3

```
print(1*2*3*4*5*6*7*8*9*10)
```

This can be broken into multiple steps by looping and using a counter:

```
input = 10
answer = 1
counter = 2
while(counter < input):
    answer = answer * counter
    counter = counter + 1
print(answer)
```

Summary

Programs execute one line at a time
Every line is an assignment, a print, or a flow-control

Design 1 Instruction of an ISA (time permitting)

Play the role of machine designer, not compiler
Instruction has an operation, 2 inputs, and 1 output
Need legal names for inputs and outputs
Let's say the only inputs allowed are r0 to r15
Need a name to set input = 10

```
equals r1 <- 10      # name can be anything, so use equal
equals r1, 10        # use , instead of <- for compatibility
eq r1, 10            # eq is operation, r1 is destination, 10 is source
ld r1, 10            # replace eq with ld (load) to avoid comparison confusion
```

Another example for multiplication:

```
mul r2, r2, r3
```