ECS10

10/10

Overview

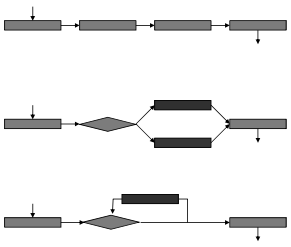
- Announcements / Homework 2
- 'While' loops
- Operators
- Functions

Announcements

- Homework 2
  - Should now be possible to submit homework 2
  - May use either nested 'if' statements or state variables
  - Ignore the 'drop' option for the homework assignment
- Assignment 3 should be up tonight
- Can't add more than 198 students because of room requirements
  - Check your position again; may have been added
  - People will likely drop today, so keep checking

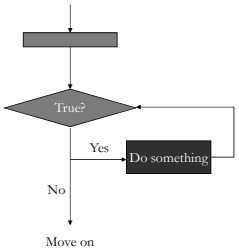
Loops: Repeating blocks

- Basic program will run through the program once
- 'if' statement changes what happens depending on the current program state, but still runs its block only once
- Loops repeat a block 0 or more times

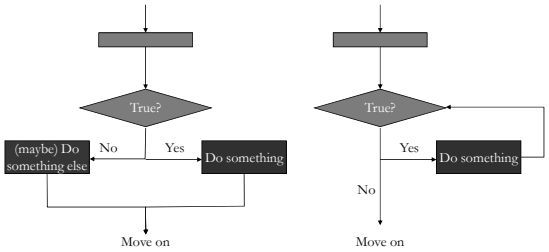


'While' loops

- '**while**' loops are one type of loop
- Repeats a block **while** some condition is True
- Once condition is False, block under while loop doesn't run
  - May never run the block!



'While' loops



if/else statement **while** loop

'While' loop dissected

- 'while' is a Python keyword which causes a block to repeat
- 'Boolean is True' is the condition. Replace with any Boolean expression or variable
- Used when you don't know how many times you need to repeat

```
whatever comes before

while Boolean is True:
      do something
      …
      do something

# Boolean no longer True
do rest of program
```

'While' loop dissected

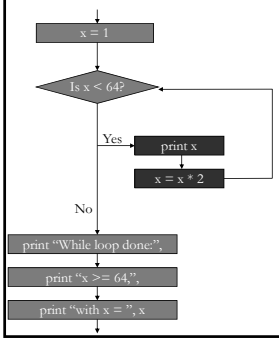
Print out powers of 2
until x >= 64
Set x to 1

While x is less than 64:
  Print out x
  Multiply x by 2 and store in x

Boolean no longer True
Say that the while loop is done
Print that we expect x < 64 to be False
Print out the final value of x

```
# Print out powers of 2
# until x >= 64
x = 1

while x < 64:
      print x
      x = x * 2

# Boolean no longer True
print "While loop done:",
print "x >= 64,",
print "with x =", x
```

'While' loop dissected



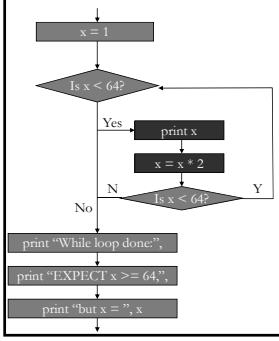

```
# Print out powers of 2
# until x >= 64
x = 1

while x < 64:
      print x
      x = x * 2

# Boolean no longer True
print "While loop done:",
print "x >= 64,",
print "with x =", x
```

Side note: DON'T use break

- You may see the '**break**' keyword being mentioned with loops
- **DON'T use it for this course**
- **break** ends the **while** loop early
  - Can't make any assumptions about the condition used by the while loop

```
# Print out powers of 2
# until x >= 64
x = 1

while x < 64:
      print x
      x = x * 2

# Boolean no longer True
print "While loop done:",
print "x >= 64,",
print "with x =", x
```

Side note: DON'T use break




```
# Print out powers of 2
# until x >= 64
x = 1

while x < 64:
      print x
      x = x * 2
      if x > 10:
            break

# CAN'T ASSUME X >= 64
print "While loop done:",
print "EXPECT x >= 64,",
print "but x =", x
```

Coin Flipping

- Last time, wrote program to flip a single coin
- Big topic in probability
  - Is it possible to flip 10 heads in a row?
  - How long do you have to flip before getting 3 heads total?
- Use 'while' loop to flip coins until three heads get flipped

Heads
Tails
Tails
Heads
Tails
Tails
Tails
Heads

Coin flipping: In English

Set number of heads = 0

While number of heads < 3:
- Flip a coin
- If the coin is heads:
  - Print "Heads"
  - Increment number of heads
- Else (the coin had to be tails):
  - Print "Tails"

Coin flipping: In Python

Gain access to the random module

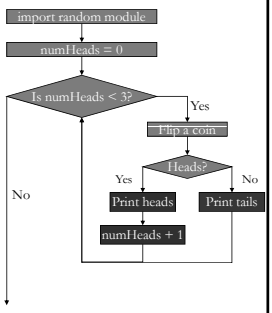
Set number of heads = 0

While number of heads < 3:
- Flip a coin
- If the coin is heads:
  - Print "Heads"
  - Increment head count
- Else (the coin had to be tails):
  - Print "Tails"

```
import random

numHeads = 0

while numHeads < 3:
   coin = random.randint(1,2)
   if coin == 1:
      print "Heads!"
      numHeads = numHeads+1
   else: # expect coin == 2
      print "Tails!"
```

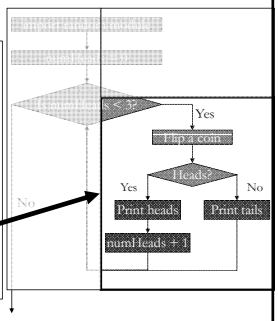
Coin flipping: As a flowchart

```
import random

numHeads = 0

while numHeads < 3:
   coin = random.randint(1,2)
   if coin == 1:
      print "Heads!"
      numHeads = numHeads+1
   else: # expect coin == 2
      print "Tails!"
```



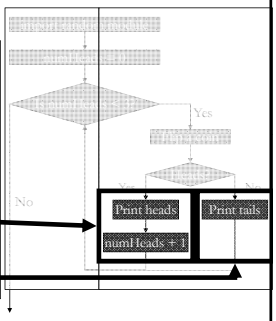
Coin flipping dissected

```
import random

numHeads = 0

while numHeads < 3:
   coin = random.randint(1,2)
   if coin == 1:
      print "Heads!"
      numHeads = numHeads+1
   else: # expect coin == 2
      print "Tails!"
```



Coin flipping dissected

```
import random

numHeads = 0

while numHeads < 3:
   coin = random.randint(1,2)
   if coin == 1:
      print "Heads!"
      numHeads = numHeads+1
   else: # expect coin == 2
      print "Tails!"
```



Getting valid input

```
choosing = True
while choosing:
    input = raw_input("Choose h or t: ")
    if input == "h" or input == "t":
        choosing = False
```

"State" variable, redux

- choosing is a Boolean variable
- choosing == True while the user still has to choose 'h' or 't'
- Becomes False as soon as a valid choice is made
- It is a data item that never appears as input or output of the program; it is just there to keep track of how things are going internally.

Infinite loop

- One of the classic programming bugs
- Get out of it using CTRL-c (hold down control key and type c)
- Repeat after me: CTRL-c

```
x = 0

while x < 5:
   print "I'm stuck!"

# Never reaches here
print "I'm out!"
```

Next assignment: compound interest program

- Original debt is $10,000
- While you still owe money, make a payment and pay interest
- Program ends when debt is paid off

Operators

- 'Operators' perform basic operations
- Typically needs 1 or 2 items of the same data type
- Usually used to combine items

Data type	Operators	Purpose
Integer	+ - / *	Arithmetic
String	+	Concatenates strings

Operators

- The same symbol can be used for different operations
- + means either 'addition' or 'concatenation', depending on the context
  - Given two numbers, adds them together
  - Given two strings, concatenates the second to the first
  - Given a string and a number, will fail to work

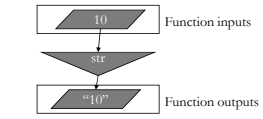
Variable 1	Variable 2	Result	Data type
1	2	3	Integer
5	6.0	11.0	Float
"Johnny "	5	FAILS	

Operators

- Fails because "+" is given two meanings
  - "Johnny" implies that + should concatenate two strings
  - 5 implies that + should add two numbers
- Since "Johnny 5" was expected, turn 5 into a string
  - Need str( ): str(5) gives "5"

Functions

- str( ) is a **function** (purple in IDLE)
- Like functions in Algebra:
  - x is input
  - f(x) evaluates to output
- Functions are like commands that are "added in" to the basic Python language.
- The value of str(10) is the string "10".



print **"ECS " + str(10)**

print **"ECS " + "10"**

print **"ECS 10"**

raw_input()

- raw_input( ) is a function
- It prints out its string, waits for a response.
- Its value is the user's response (what the user types).
- Here, the value gets stored in the variable reply.

```
raw_input("Press enter to exit:")

reply = raw_input("Enter the answer:")
```