ECS10
10/12

Compound interest
- Say you invest $100 and make 7% annually
- After one year you have:
  \[ $100 + $100 \times \frac{7}{100} = $107 \]
  You made $7.00
- If you leave it invested, and make another 7% the next year, you have:
  \[ $107 + $107 \times \frac{7}{100} = $114.48 \]
  You made $7.49

“Compounded monthly”
- Instead of computing and adding interest every year, do it every month.
- Use interest rate of \( \frac{7}{12} \)% = 0.583% every month
- Is 9% compounded monthly better than 9% compounded annually? Is it exactly the same?

Compute Interest Compounded Monthly
- Write a program to calculate it.
- Use a while loop to iterate through 12 months
- See how much you make on $100
- Style point: write a few lines, run, write a few more….work in small steps.
  - 1. get some data into some variables
  - 2. compute the interest
  - 3. allow user to give input

Program Crash
- Python refuses to run your program because it contains an error.
- Nasty red error messages
- Your goal as a programmer is for your programs never to crash.
- Windows crashes sometimes. IDLE crashes sometime. And you say…. 
Why is this program crashing?

- It tells us the line:
  
  ```python
  monthlyRate = annualRate/12.0
  ```

- It tells us what it doesn't like:
  
  ```
  unsupported operand type(s) for /: 'str' and 'float'
  ```

- Function `raw_input()` returns a string
- Cannot divide a string by 12.0

Converting strings to numbers

- Use Python functions:
  
  ```python
  int()
  float()
  ```

- Examples:
  
  ```
  x = int("26")  # x now contains the integer 26
  y = float("7.5")  # y now contains the float 7.5
  ```

Still crashes!

- The input to `float()` has to be a string that represents a float.
- The input to `int()` has to be a string that represents an integer
  
  ```
  float("2.366")  # does not crash
  float("12")  # does not crash
  float("cow")  # crashes!
  int("3.45")  # crashes!
  ```

How to fix?

- We can't control what the user enters!
- Need to check user's input before we do anything with it that might cause a crash.
- There is not a built in function in Python that checks whether a string can be converted to a float or an int
- There is a way to do this, but we haven't learned the right parts of Python yet….

A helpful module

- You need a checking function
- We'll give you a checking function
- We write a module that you can import

```python
import random
...
coin = random.randint(1,2)
```

Anybody can write a module

- Writing a module can add new functions and other language features.
- Ours will be called `helper`
- It's in the file `helper.py`
- You need to have this file in the same folder as your program so that Python can find it.
- Modules that come with Python (like `random`) are installed in other folders that Python checks automatically.
Two functions in helper

- helper.isFloat(), helper.isInt()
- Both take a string as input
- Both return a Boolean value as output

```python
goodInput = isFloat("9.2")
# now goodInput == True
goodInput = isFloat("12")
# goodInput == True
goodInput = isFloat("three")
# now goodInput == False
```

Exit with error message

- The program is not crashing.
- It tells the user what is wrong and exits normally.
- It might not do exactly what the user wants, but it is not broken. It does what it knows how to do correctly.

Clean Up

- While writing a program, include lots of print statements
- When you’re done, cut them out. The user doesn’t want all that information, just the answer.

Blocks of Program

```python
import helper
principal = 10000
rateString = raw_input("Enter annual interest rate:")
goodInput = helper.isFloat(rateString)
if not goodInput:
    print "Not a valid interest rate."
else:
    annualRate = float(rateString)
    monthlyRate = annualRate/12.0
    balance = principal
    month = 0
    while month < 12:
        balance = balance+monthlyRate/100.0*balance
        month = month+1
    eir = balance-principal
    print "interest earned is", eir
raw_input("Press enter to exit.")
```

Interest on a debt

- When you are paying interest, compound interest is a bad thing!
- Say you owe $8000, at an interest rate of 15%, and you pay it off by paying $200 a month…