

## ECS10

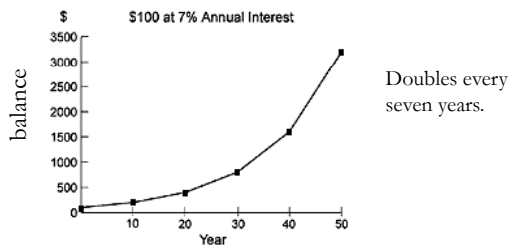
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### Compound interest

- Say you invest \$100 and make 7% annually
- After one year you have:  
 $\$100 + \$100 * 7 / 100 = \$107$   
You made \$7.00
- If you leave it invested, and make another 7% the next year, you have:  
 $\$107 + \$107 * 7 / 100 = \$114.48$   
You made \$7.49

### Compound interest

- The more you have the more you make



### “Compounded monthly”

- Instead of computing and adding interest every year, do it every month.
- Use interest rate of  $(7/12)\% = 0.583\%$  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:

```
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:

- `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
- Last time:

```
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

```
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

```
import helper
principal = 100.00
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...