

MORE STRINGS, FILE PROCESSING, AND METHODS VS. FUNCTIONS

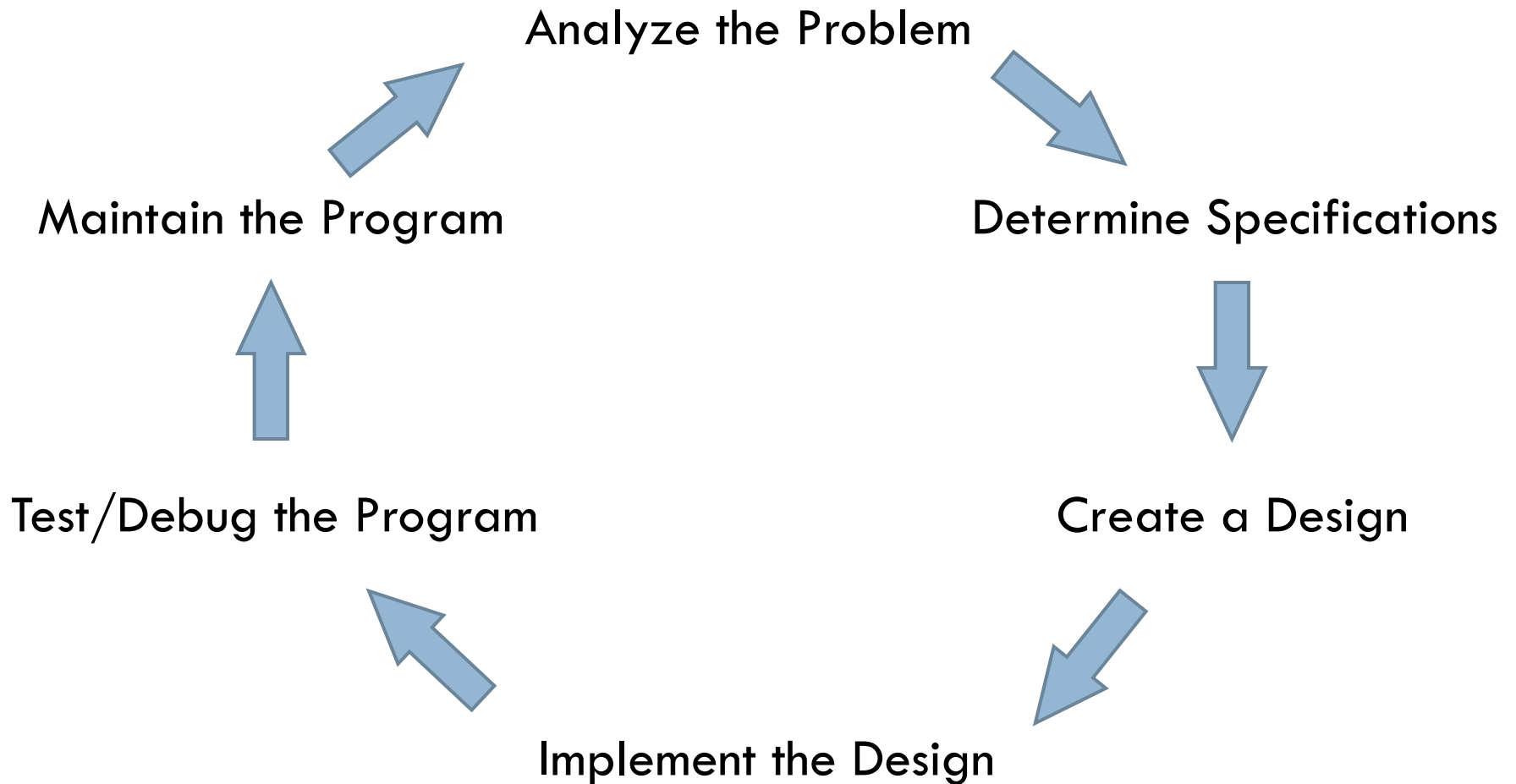
Outline

- Class exercise: processing with lists
- String representation
- More on string input and output
- File processing
- Coming attraction: Objects
- In-class practice time

Day, Month → Day of year

- When calculating the amount of money required to pay off a loan, banks often need to know what the "ordinal value" of a particular date is.
 - ▣ For example, March 6 is the 65th day of the year (in a non-leap year).
- We need a program to calculate the day of the year when given a particular month and day.

The Software Development Process



Phases of Software Development

- **Analyze:** figure out exactly what the problem to be solved is
- **Specify:** WHAT will program do? NOT HOW.
- **Design:** SKETCH how your program will do its work, design the algorithm
- **Implement:** translate design to computer language
- **Test/debug:** See if it works as expected.
bug == error, debug == find and fix errors
- **Maintain:** continue developing in response to needs of users

String Representation

- Computer stores 0s and 1s
 - ▣ Numbers stored as 0s and 1s
 - ▣ What about text?
- Text also stored as 0s and 1s
 - ▣ Each character has a code number
 - ▣ Strings are sequences of characters
 - ▣ Strings are stored as sequences of code numbers
 - ▣ Does it matter what code numbers we use?
- Translating: `ord(<char>)` `chr(<int>)`

Consistent String Encodings

- Needed to share data between computers
- Examples:
 - ▣ ASCII—American Standard Code for Info. Interchange
 - “Ask-ee”
 - Standard US keyboard characters plus “control codes”
 - ▣ Extended ASCII encodings
 - Add various international characters
 - ▣ Unicode
 - Tens of thousands of characters
 - Nearly every written language known

Class Exercise: Encoding

- Download `encode.py` from Angel:
 - Lessons → Modules to Download in Class →
encode module
- Verify that the module works on your computer:
 - Run the module
 - Enter the message: `Spam`
 - Enter the key: `1`
 - Expected result: `[84, 113, 98, 110]`
- Answer In-class Quiz questions 4 and 5

The `eval` Function

- Syntax:
 - ▣ `eval(<string>)`
- Semantics
 - ▣ Input: any string
 - ▣ Output: result of evaluating the string as if it were a Python expression

In-class Exercise

- Create a new module named `decode.py`
- Implement the module so it:
 - ▣ Prompts the user for a list of numbers
 - ▣ Prompts the user for a key
 - ▣ Reverses the calculation from the encode module to return the original string

String Formatting

- The % operator is *overloaded*
 - Multiple meanings depending on context
- What does it mean for numbers?
- Other meaning for <string> % <tuple>
 - Plug values from tuple into “slots” in string
 - Slots given by *format specifiers*

Format Specifiers

- Syntax:
 - `%<width>.<precision><typeChar>`
- Width gives total spaces to use
 - 0 means as many as needed
 - `0n` means pad with leading 0s to *n* **total** spaces
 - `-n` means “left justify” in the *n* spaces
- Precision gives digits after decimal point
- TypeChar is:
 - `f` for float, `s` for string, or `d` for decimal (i.e., int)

File Processing

- Manipulating data stored on disk
- Key steps:
 - ▣ *Open* file
 - For reading or writing
 - Associates file on disk with a *file variable* in program
 - ▣ *Manipulate* file with operations on file variable
 - Read or write information
 - ▣ *Close* file
 - Causes final “bookkeeping” to happen

File Writing in Python

- Open file:
 - ▣ Syntax: `<filevar> = open(<name>, <mode>)`
 - ▣ Example: `file_to_write = open('average.txt', 'w')`
 - Replaces contents!
- Write file:
 - ▣ Syntax: `<filevar>.write(<string>)`
- Close file:
 - ▣ Syntax: `<filevar>.close()`
 - ▣ Example: `file_to_write.close()`

File Reading in Python

- Open file: `file_to_read = open('grades.txt', 'r')`
- Read file:
 - `<filevar>.read()` Returns one **BIG** string
 - `<filevar>.readline()` Returns next line, including `\n`
 - `<filevar>.readlines()` Returns **BIG** list of strings, 1 per line
 - `for <ind> in <filevar>` Iterates over lines efficiently
- Close file: `file_to_read.close()`

A “Big” Difference

- Consider:
 - ▣ `file_to_read = open ('grades.txt', 'r')`
`for line in file_to_read.readlines():`
`# process line`
`file_to_read.close()`
 - ▣ `file_to_read = open ('grades.txt', 'r')`
`for line in file_to_read:`
`# process line`
`file_to_read.close()`
- Which takes the least memory?

Up Next: Objects

- Why do we apply some operations like this:
 - `infile = open('file.txt','r')`
 - `abs(-1.2)`
- and others like this:
 - `infile.read()`
 - `circle.draw(win)`
- Files and circles are *objects*—data plus operations
- `<object>.<methodName>()` is a *method call*
 - Tells object to do something

Practice

- Hand in quiz
- Start working on HW5
 - ▣ Practice with string formatting
 - ▣ Practice with file processing
- On Angel
 - ▣ Lessons → Homework → Homework 5 →
Homework 5 Instructions