DSC 510

WEEK 1

Computer

A **computer** is an electronic device which takes input from the user, processes the input, and outputs the results for the user.

- The following devices are examples of computers:
- cell phones
- iPods
- Tablets.

Input consists of any form of instruction or data the user provides the computer.

Process consists of processing instructions and data and storing results.

Output consists of displaying the stored results or printing the output.

Computer Hardware

A computer system consists of multiple pieces of hardware that allow the system to function. Among these pieces of hardware are:

- Central Processing Unit (CPU): The brain of the machine. This is where all the basic operations of the computer are carried out. The CPU tells the rest of the computer what to do.
- Memory: The memory of a machine stores programs and data. Computers have two different types of memory: main memory and secondary memory.
- Input/Output devices: Input and output devices allow users to interact with the computer. Examples of Input devices are the computer mouse and keyboard. Examples of output devices are the computer's monitor and a printer. Information from input devices is process by the CPU and may be stored in main memory or secondary memory such as RAM.

Main Memory

Main memory is the computer’s work area. This is where the computer stores the program that is running, as well as the current data. Main memory is commonly known as the random-access memory (RAM). The features of RAM are:

- Quick access to data
- Volatile memory used for temporary storage
- Erased when computer is turned off

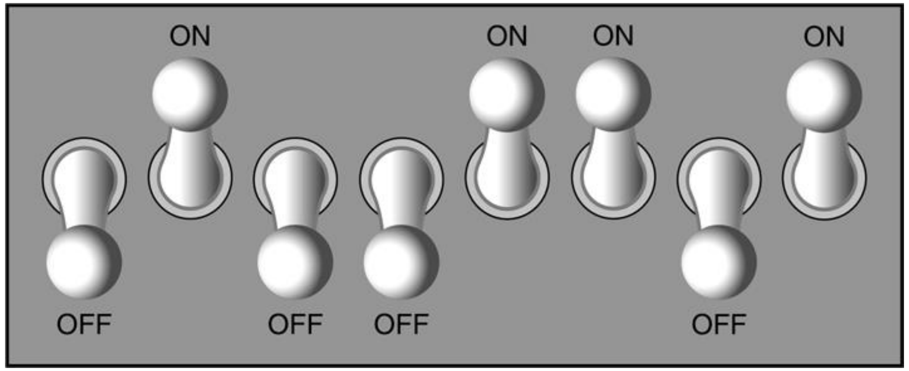
Secondary Memory

Secondary memory is a type of memory that can hold data for long periods of time. Programs that aren’t currently running and important data that will be needed long term are stored in secondary storage. The hard drive is common type of secondary storage. Secondary memory is stored by magnetically encoding it onto a circular disk or other storage device, usually an internal hard drive, that is installed in the computer. Some systems include external hard drives, which are often used to create backup copies or provide additional storage.

Storing Information

A computer's memory is divided into tiny storage locations known as bytes. Here are some facts about bytes:

- One byte represents one number
- A byte is divided into eight smaller storage locations known as bits (binary digits)
- Bits are tiny electrical components that can hold either a positive or a negative charge
- A positive charge is similar to a switch in the on position
- A negative charge is similar to a switch in the off position



Storing Numbers

- Binary numbers are made up of sequences of 1s and 0s.
- One byte represents one number.
- A byte is divided into eight smaller storage locations known as bits (binary digits).
- Bits are tiny electrical components that can hold either a positive or a negative charge.
  - A positive charge is similar to a switch in the on position (this is 1 in the binary system).
  - A negative charge is similar to a switch in the off position (this is 0 in the binary system).

For more information on binary visit Learning Binary and Hexadecimal, Jeremy Falcon, (2014).

Computer Program/Software

A computer program is a sequence of instructions that are processed by a computer's CPU. These instructions tell the computer to perform a specific set of tasks. The instructions must be in a language that the computer can understand (known as machine code). In order to get these instructions into machine code, a software developer writes a source code using one of many programming languages, such as Python. When source code is written, it must follow rules specific to the programming language. These rules are called syntax. A set of instructions written in proper source code with the proper syntax is called a program. Another term for program is software. There are two categories of software:

- System software
- Application software

Compiled and Interpreted Programs

Compiled Languages: A compiler is a program that converts human-readable code into machine-readable code. Compiled languages require a compiler to convert source code into a computer's machine language. Once the code is compiled, the program can be executed on the chosen platform. With compiled languages the source code only needs to be compiled once and then the application can be run multiple times. In most cases, compiled languages execute faster than interpreted languages. C, C++, Java, and ASP.NET are examples of compiled languages.

Interpreted Languages: Interpreted languages use an interpreter to convert source code into machine code one line at a time when the application is executed. Each time the program is run the source code is interpreted. Python, Perl, and Javascript are examples of interpreted languages.

Compiling Process

These are the steps of the compiling process:

- A programmer writes source code.
- The source code is input into a compiler.
- The compiler converts the the source code into a machine-readable language by:
    - Optimizing the source code
    - Generating object code
    - Linking object code to libraries that help the object code run correctly
    - Read more about the compiling process and view a process flowchart here: The Basics of Compiled Languages, Interpreted Languages, and Just-in-Time Compilers. Carey Wodehouse.

Python 2 vs Python 3

What are the differences?

Short version:

- *Python 2.x is legacy,*
- *Python 3.x is the present and future of the language*

Python 3.0 was released in 2008. The final 2.x version 2.7 release came out in mid-2010, with a statement of extended support for this end-of-life release. The 2.x branch will see no new major releases after that. 3.x is under active development and has already seen over five years of stable releases, including version 3.3 in 2012, 3.4 in 2014, 3.5 in 2015, and 3.6 in 2016. This means that all recent standard library improvements, for example, are only available by default in Python 3.x.

Python 2 vs Python 3 continued...

Guido van Rossum (the original creator of the Python language) decided to clean up Python 2.x properly, with less regard for backwards compatibility than is the case for new releases in the 2.x range. The most drastic improvement is the better Unicode support (with all text strings being Unicode by default) as well as saner bytes/Unicode separation.

Besides, several aspects of the core language (such as print and exec being statements, integers using floor division) have been adjusted to be easier for newcomers to learn and to be more consistent with the rest of the language, and old cruft has been removed (for example, all classes are now new-style, "range()" returns a memory efficient iterable, not a list as in 2.x).

The What's New in Python 3.0 document provides a good overview of the major language changes and likely sources of incompatibility with existing Python 2.x code. Nick Coghlan (one of the CPython core developers) has also created a relatively extensive FAQ regarding the transition.

However, the broader Python ecosystem has amassed a significant amount of quality software over the years. The downside of breaking backwards compatibility in 3.x is that some of that software (especially in-house software in companies) still doesn't work on 3.x yet.

Deciding Which Python Version to Use

Deciding which version of Python to use will depend on your specific circumstances. Mac and Linux/Unix operating systems generally come preinstalled with Python. For ease of use, you may wish to use the preinstalled version. The Python community, however, recommends that new developers start with Python 3.

Python 2 has better library support than Python 3 so depending on which libraries you need to use for your program may also influence the version of Python you use.

Additional Documentation regarding Python 2-3 differences

The key differences between Python 2.7.x and Python 3.x with examples. Sabastian Raschka. (2014)

Checking for Python Installation

Before Installing Python it is advisable to determine if Python has been installed on your PC. From the command prompt simply type “Python”. You should see results similar to below:

```
C:\Users\mikee>python
Python 2.7.14 (v2.7.14:84471935ed, Sep 16 2017, 20:25:58) [MSC v.1500 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

Installing Python

Installing Python is a relatively simple activity. In General these are the high level step actions for installing Python from a WINDOWS PC.

1. Download the Python installer
2. Run Python Installer
3. Add the Python Home directory to your Path
4. Test Python installation by running the “Python” command from the command line.

Python IDEs

An IDE is an Integrated Development Environment and make writing programs more effective by using certain language specific features such as syntax highlighting and completion.

Python comes with a built in IDE called IDLE. IDLE is great for short programs and for testing purposes however other IDEs such as PyCharm, ATOM, and NOTEPAD++ are often more efficient for larger programs. Throughout this class we will use PyCharm to write our applications.

Atom. Atom Editor
Notepad++. Don Ho. (2019)
The Python IDE for Professional Developers. JetBrains

IDLE

IDLE is Python’s Integrated Development and Learning Environment.

IDLE has the following features:

- coded in 100% pure Python, using the **tkinter** GUI toolkit
- cross-platform: works mostly the same on Windows, Unix, and Mac OS X
- Python shell window (interactive interpreter) with colorizing of code input, output, and error messages
- multi-window text editor with multiple undo, Python colorizing, smart indent, call tips, auto completion, and other features
- search within any window, replace within editor windows, and search through multiple files (grep)
- debugger with persistent breakpoints, stepping, and viewing of global and local namespaces
- configuration, browsers, and other dialogs

NOTE: Additional Information on IDLE usage can be obtained here: https://docs.python.org/2/tutorial/interpreter.html

PyCharm

- PyCharm is a Python IDE for professional programmers. We will be using PyCharm in this class to complete assignments.
- JET Brains has a video series regarding PyCharm that everyone should review before using PyCharm.

What is Github?

Have you heard of Dropbox? Google Drive? The Cloud? Github is *sort of* these things.

From Github itself: What is GitHub? GitHub. (2016).

In plain English: it is a way to make sure the coding stuff you're working on is backed up and accessible for people who might also be working with you. It has version control and very structured collaborative features. For example, if a ton of people make changes to something inside your folder then you or those you designate as capable of making changes can go through each suggested change and merge them all.

GitHub

- GitHub is an web based open source version control solution which we will use for this course.
- GitHub allows developers to share code with other individuals while keeping track of the changes to a specific code base.
- There are multiple ways that you can interact with GitHub. These include cloning from the GitHub URL, using GIT (i.e. commandline), using a tool such as Sourcetree (GUI). Each of these tools offer the capabilitiy to interact with GIT repositories.
- Essentially GIT is the foundation and is the underlying technology which allows you to create code repositories. GITHub is an online tool which allows users to create and interact with GIT repositories. Sourcetree is a GUI which allows you to interact with remote or local GIT repositories.
- This video is a fantastic intro into Git/GitHub

Getting started with Github

First things first, let's take a bit of a tour of everything related to Github:

This tutorial is also interesting. It will help to introduce you to something else we'll be talking about *introducing you to other ways to do python.*

This is a good place to see *how* things work.

This tutorial will usually have the most introductory aspects to Github. It is a useful refresher if it's been a while. It's also a useful space to learn those things that mark every aspect of learning how to *be* in a technical space:

vocabulary

concepts

Learning how to speak like someone who does technical stuff is just as important (for your career) as learning how things work.

PyCharm and GitHub

Now that we’ve set up PyCharm and GitHub we can integrate PyCharm and Github.

This tutorial will help you get started with integration.

Now, there's something to think about with this. You don't *have* to understand this product from beginning to end. All you need to do are two specific things right now:

- Get files into the repository you want.
- Download files from that repository.
- And you can do that using something like
  - GitHub Desktop
  - SourceTree

  These two products work a lot like Dropbox or Google Drive. They are ways for you to grab (pull) or send (push) to a folder that exists on a computer hard drive that is replicated and redundant in many different ways. So it's replicated, redundant, and this means your data won't disappear. However, this also doesn't mean you can't make mistakes and do something to your data. You can always overwrite, not save, or screw up your data. And you will. Don't worry, you'll make a ton of mistakes!