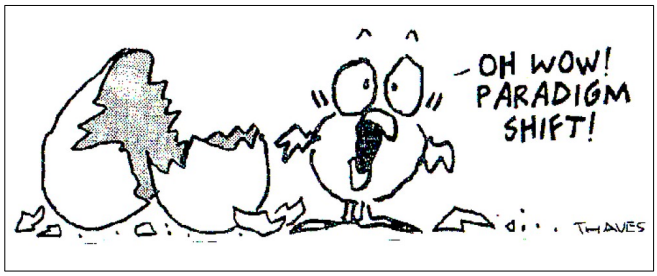
CS118
Understanding Computers

Computer as an appliance

Since students today have always seen personal computers and used the Internet from a very young age, it is frequently the case that they use them as anybody would use an appliance. That is: they turn it on, use the applications that are readily available, and turn it off – much like a television. As they get more accustomed to it they learned to obtain new applications; but just as very few people would build their own television, very few people consider building their own application for the computer.



Imagine if you bought a television with only one channel available. You could watch more shows on other channels, but you first have to "build" a channel into the television. Every other person watches one channel but you can watch the 20 or 30 that you built! Just so, a computer comes with certain applications and you can download more. But it has the ability to be anything you want. You just have to learn to build the application you want.

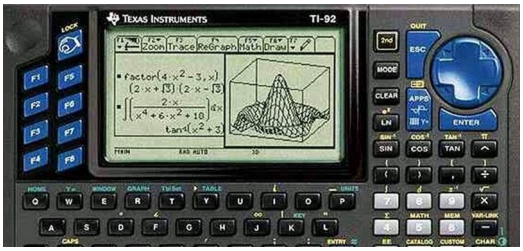
Computer

A computer is a device which can be given a set of instructions (a *program*) that it will execute automatically in order to manipulate information.

Computer vs. Calculator

A computer and a calculator are very similar devices. Traditionally, the calculator was viewed as not being programmable. That is no longer the case. The primary technical differences between "calculators" and "computers" involve the ability to use complex data structures. Thus the only significant difference is in the complexity of the language that is available, which is primarily determined by the demands of the customers (i.e. how "powerful" they want the programming). So any company making a "calculator" could turn it into a full-fledged computer if they're willing to provide the necessary programming language with requisite data handling (arrays, structures, objects, files, etc).

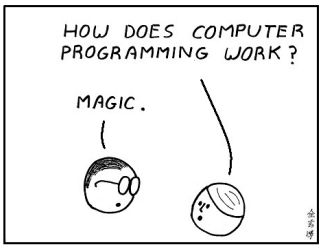
Most people don't think of functionality when deciding what is a computer, though. Most people will call it a computer when the device has a *graphical user interface* (i.e. windows, buttons, drag-and-drop, etc). So people don't think of a smartphone as a calculator – they think of it as a handheld computer. (And they're actually correct from the technical side!)



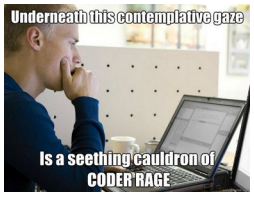
The crux of this is that a "calculator" in your hand may actually be considered a small "computer" and the differences can be inconsequential. For our purposes we will define a calculator to be: "A handheld computation device with no graphical input capability." Note that this specifically excludes *output*. The screen may produce graphical output but if buttons/keys are used for input, we'll consider a calculator (because that's how most people would view it).

Program
A program is a set of of instructions given to a computer to be executed. Also known as "code".

Analogy
When you press buttons on a microwave oven, you are providing instructions to the device ("Turn on for 60 seconds") and then you execute those instructions by pressing another button ("Start"). Some microwave ovens permit you to provide longer "programs" ("Cook for 5 minutes at 100% power, then cook for 10 minutes at 50% power"). Those instructions are not saved, so you get to enter them every time you want to cook something. The analogy applies to computer programs except that we'll save our "cooking instructions" for re-use. And they'll be much more complex in what they can accomplish.

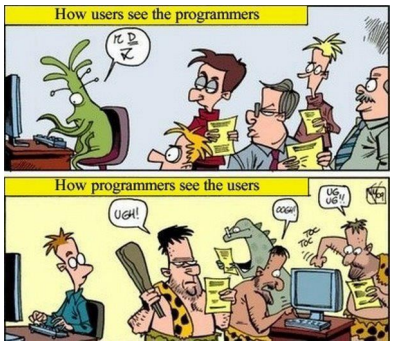


Side note
Programs are thought of in two contexts. The first is as a single entity, like "the program, Microsoft Word". But since a program is made up of instructions, people who create the program will think of it as a set of individual instructions and will refer to these instructions as "the code for Microsoft Word" (or simply "the code" since they know what it is supposed to do).



Programming
Creating, testing, and revising a set of instructions to be executed by a computers. Also known as "coding".

Programmer
The role played by a person who creates the set of instructions that will have the computer accomplish a desired task. The programmer and the user are two roles being played by the same person while the program (aka "code") is being developed.



User
The role played by a person who uses a computer while it is executing a program. The user may interact with the program by providing input or receiving output. The programmer and the user are two roles that can be played by the same person while the program (aka "code") is being developed.

Problem Solving using Computers
There are six fundamental tasks that a computer can perform:

- It can save a value in memory for reference and modification
- It can reference memory and perform mathematical operations on values from memory
- It can receive input – it can get information from outside the set of instructions
- It can produce output – it can provide information for access outside of its instructions
- It can compare values to determine if one or more instructions should be executed
- It can repeat instructions when the conditions warrant

(For those technically inclined, input and output are actually just variations on saving information. But from the programmer perspective it's advantageous to view them as separate tools.)

Your assignment:

#1: From the microwave analogy on page 2:

a) Who is the "programmer"? What "programming tasks" does this person perform?

b) Who is the "user"? What tasks does the user perform with respect to the microwave?

c) Describe a scenario where the programmer and the user of the microwave are two different people.

#2: Think about, discuss with others, research online – do what is necessary to describe accurately how a person is both a *programmer* and a *user* when performing computational problem solving. (HINT: What does each role do when problem solving?)

#1: From the microwave analogy on page 2:

a) Who is the "programmer"? What "programming tasks" does this person perform?

a1) The programmer is the person specifying the tasks to be performed by the microwave.
a2) Specifying time, power, temperature or other parameters in the execution sequence.

b) Who is the "user"? What tasks does the user perform with respect to the microwave?

b1) The user is the person causing the program to be executed.
b2) Pressing the START key to cause the program to execute.

c) Describe a scenario where the programmer and the user of the microwave are two different people.

Mom programs the microwave to be used by Dad when he gets up later. Dad will use the program to cook the food for his meal, but Mom was the programmer.

#2: Think about, discuss with others, research online – do what is necessary to describe accurately how a person is both a *programmer* and a *user* when performing computational problem solving. (HINT: What does each role do when problem solving?)

Performing computational problem solving involves determination of the necessary tasks in the correct sequence, and then implementing those tasks. Since making errors are human nature, the person who writes the tasks must then test them to be sure they're correct – at that point, s/he becomes the user for that testing phase. Assuming flaws are present, the person will revert to the programmer role to make changes. These role changes continue until the development is complete.