**OMG – CS …..or….**

 **“I’m taking a course using computer science – what is computer science?”**

**Computer science is about trying to solve problems which need to be done with a computer.**

**CS is NOT just programming --** programming is a vehicle to solve problems, in the same way that a microscope is a vehicle for examining organisms.

**When we look at a problem we ask questions like:**

* Can it be done?
* Can it be done in a reasonable amount of time with a reasonable amount of resources?
* What’s the best way to do this?
* Example: If we have a bunch of animals (or bacteria) for which we have the complete genome, what is the longest common substring?
(Once we get to a lot of organisms, this is a hard problem.)
* Example: I’ve just picked up a message that the Russian foreign office sent to their embassy in Beijing. It’s clearly in code. Can I crack the code & read the message before it’s too late?
* Example: What is a good way to arrange electronic medical records for cancer patients who have had their tumors sequenced so that I protect all the patients’ privacy but can still do research on what kinds of genetic signatures respond to what kinds of treatments?
* Example: How can I visualize the relationships among various genes (or proteins) so that I can investigate which viruses (known to attack some genes) have a relationship with certain cancers? (Stay tuned – we are really going to focus on this) How should I represent these relationships in a computer so that I can investigate them analytically?
* Bottom line: we are talking about the *complexity* of solving a problem, about designing *algorithms* (recipes for solving the problem), about *data structures* (ways to represent and organize information) and *data bases* (organized stores for information which are shared by many users.) We are also talking about *networks* to represent relationships among items. (There are lots of other networks in computer science, too – computer networks, social networks like Facebook, and many more.)

**What else is there in CS?**

* *Theory* which underlines all these areas – you don’t want to spend a lot of a time on a problem which is known to be unsolvable in a reasonable amount of time.
* *Design* - of algorithms, data bases, computer languages, operating systems, programs, hardware (including toys like mobile devices), web sites, etc. and good methodologies for designing and updating computer systems which change rapidly. (Yahoo!’s home page changes every 2 weeks!) And, of course, design of programs (i.e. solutions). There is lots of opportunity to be creative in computer science.
* *Systems* *problems* – including operating systems, networks, information security (preventing viruses and unauthorized users from getting at your system, but also policies about who can see what).
* *Usability* - how to make your programs, web sites, etc. easy for people to use and benefit from . *Computer* *Graphics* helps people understand data too, as well as being a critical component of MRI and CT scans.
* *Problem* *solving* – which is the whole point of it all. But this also gets back to the issues of complexity, reliability, and efficiency. And also some programming, of course.
* And *simulation*! ( or getting a computer to imitate a physical system. We can’t observe the ‘big bang’ or wait for ‘global warming’ but we can try to simulate these events.)
* Lots of *inter-disciplinary* issues. For example, people who think about hardware issues also work with computer engineers, people who work in cryptography (making & breaking secret codes) work with mathematicians, people who work in bioinformatics work with biochemists, etc. And, of course when you join Computer Science with Statistics, you get *Data Science*.