**First Chapter Notes**

* A modern Computer is:
  + A machine that stores and manipulates information under the control of a changeable program.
    - Computers are devices for manipulating information.
      * We can put information into a computer, and it can transform the information into new, useful forms then output or display it for our interpretation.
    - Computers aren’t the only machines that manipulate information. There are other devices that are not full-fledged computers but can manipulate data, such as:
      * Calculators.
        + EX: when you add up a column of numbers, you enter information (the numbers) and the calculator is processing the calculator is processing the information to compute a running sum which is then displayed.
      * Gas pumps.
        + EX: As you fill your tank, the pump uses certain inputs: The current price of gas per gallon and the signals from a sensor that reads the rate of gas flowing into the car. The pump transforms this input into information about how much gas you took and how much money you owe.
    - What exactly does “Computers operate under the control of a changeable program” mean?
      * A computer program is a detailed step by step set of instructions telling a computer exactly what to do. If the program is changed then the computer performs a different sequence of actions (different task).
* There are different kinds of computers such as:
  + Macintoshes
  + PCs
  + Laptops
  + Tablets
  + Smartphones
  + There are also thousands of other kinds of computers, both real and theoretical.

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* Program Power
  + Programs are software that rules the hardware and determines what any computer can do.
    - Without software, computers would just be expensive paperweights.
  + The process of creating software is called programming.
    - Computer programming is a changing activity, good programming requires an ability to see the big picture while paying attention to minute detail.
    - Not everyone has the talent to become a first-class programmer, just as not everyone has the skills to be a professional athlete. However, virtually anyone can learn how to program computers with some patience and effort.
    - **Programming is a fundamental part of computer science and is important to anyone interested in becoming a computer professional.**

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* Computer Science
  + Computer Science is not the study of computers. “Computers are to computer science what telescopes are to astronomy.
  + The computer is just a tool in computer science, but it isn’t itself the object of study.
* What can be computed?
  + Computer scientists use numerous techniques of investigating to answer this question, the three main ones are:
    - Design
      * The Design of algorithms is one of the most important facets of computer science.
      * One weakness of design is that it can only answer the question “What is computable?” in the positive. If I can devise an algorithm, then the problem is solvable. However, failing to find an algorithm doesn’t mean that a problem is unsolvable. It may mean that I am just no smart enough, or I haven’t hit upon the right idea yet and this is where analysis comes in.
    - Analysis
      * Analysis is the process of examining algorithms and problems mathematically. Computer scientists have shown that some seemingly simple problems are not solvable by any algorithm. Other problems are interactable.
        + The algorithms that solve these problems take too long or require too much memory to be of practical value.
        + Analysis of algorithms is an important part of computer science.
        + Some problems are too complex or ill-defined to lend themselves to analysis. In such cases, Computer scientists rely on experimentation.
    - Experimentation.
      * After theoretical analysis is done, experimentation is often needed in order to verify and refine the analysis.
  + **Computer Scientists** **create the recipe (algorithms) and computer programmers follow it.**
  + Computer scientists are involved in far-flung activities, all of which fall under the general umbrella of computing.
* Hardware Basics
  + Programmers don’t have to know all the details of how a computer works to be successful.
  + Understanding the underlying principle will help programmers master the steps a program goes through to be brought into action.
    - It is like driving a car, knowing a little about internal combustion engines helps to explain things like why filling the gas tank, starting the engine, stepping on the accelerator, and so on are important.
  + A look under the hood of a computer:
    - Different computers can vary significantly in specific details but at a higher level all modern digital computers are remarkably similar.
      * The CPU is the brain of the machine.
        + The CPU is where all the basic operations of the computer are carried out.
      * The GPU (graphics processing unit) can perform simple arithmetic operations:
        + Such as adding two numbers and can also do logical operations like testing to see if two numbers are equal.
      * The Memory stores programs and data:
        + The CPU can directly access only information that is stored in main memory (RAM-Random Access Memory).
        + Main memory is fast, but it is also volatile (when the power is turned off, the information in the memory is lost).
      * Secondary Memory
        + A more permanent storage such as:

HDD (Hard Disk Drive)

SSD (Solid State Drive)

* Programming Languages
  + A program is a sequence of instructions telling a computer what to do.
    - The program needs to be in a language that a computer can understand (a programming language).
  + It would be neat if computers could understand human languages, but human languages are not very well suited for describing complex algorithms. Natural language is fraught with ambiguity and imprecision.