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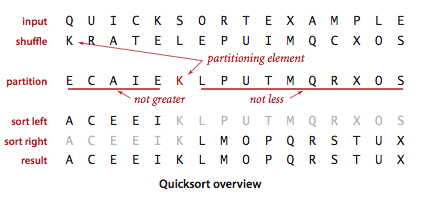
Algorithms and Data Structures

What is an algorithm, and why is it important? Whether you’re using Microsoft Word, Chrome, or even just looking something up on Google, algorithms are a part of the fabric that composes our daily experiences. Have you ever made cookies? If so, you’ve followed an algorithm; you just didn’t know it. The term “algorithm” is simply another way of describing a list of instructions. Surprising? Perhaps at first, but that’s how computer programs are created too. Now, granted, the previous example of making cookies is an incredibly simple algorithm in comparison to the process your word processor follows to pull and store text for you, but that is what an algorithm is.

So, when do we use algorithms in computing? Fundamentally, algorithms are used to solve problems. A few of these problems are decision problems, counting problems, and optimization problems. With a decision problem you ask a yes or no question, then use an algorithm, or perhaps more than one, in order to receive that answer. This is what is generally known as Boolean or “true or false” logic. Counting problems are similar to decision problems, except that it evaluates a decision problem, and determines how many possible solutions there are. In conjunction with the previous two problems, an optimization problem is more easily solved. In this type of problem, you evaluate the possible options given by a counting problem and determine the best, or most efficient, route to follow.

So what do we do when we get this data? Where does it go? It goes to what are commonly known as databases. A database is just about anything that stores data, or information. However, in the world of computers the most common database that you’ll encounter firsthand is what’s known as a file system database. If you have ever downloaded files and put them on your computer, or created shortcuts, or moved a folder or file anywhere, you’ve worked with a database. It probably came to you relatively intuitively because a file system database is created the way folder are in a filing cabinet, hence the name.

Once you understand databases a little better, you’ll probably begin to wonder as to what some of the most common algorithms are. I’ll show you a couple of them. One of the most important types of algorithms is the sort algorithm, which does exactly as it sounds. One such well known sort algorithm is the quicksort algorithm. This is a simple method that splits the list into two parts, then sorts them independently.



Remember that term I mentioned earlier, “binary?” Another of the algorithms is called a Binary Search Algorithm. Once you have sorted a list, this algorithm takes a list of objects and finds the position of a specified item. It functions by taking the term that you want found and comparing it to the term in the middle of the list, then if the value is not found, it search either above or below depending on the value. This essentially successively cuts the list in half with each iteration which logarithmically decreases the time spent searching.

So why are algorithms important? Algorithms help us to understand and comprehend the world around us. They allow us to understand large sets of data, and solve problems with computers that we could never otherwise solve. Algorithms help us solve problems and make life a little easier for humanity. Algorithms are order. They exist in nature, in science, and they create the world that we experience every day.

*If you’re still interested in these topics, I suggest taking CSS 303 - Algorithmic Number Theory and Cryptography and/or CS 500 - Database Theory. Also, if you want to become a part of groups surrounding these topics, check out ACM’s Special Interest Group On Management Of Data or their* *Special Interest Group on Algorithms and Computation Theory.*

Works Cited

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Watson and Cognitive Computing

Watson and the future of cognitive computing is an article that discusses a super computer, Watson; the first computer Jeopardy champion. The problems that the developers have begun to explore with Watson rely on massive processing in short time periods, so that it can interact in pseudo-human behavior. However, it is the approach of the developers, approaching it from a randomly determined problem, as opposed to a set one. It is not built on deterministic, yes or no, algorithms, but rather on probabilistic algorithms.

The applications of this technology are widespread and apply to just about every field. This could be used on the consumer level with cellphones, or with the producers in determining important functions of businesses. Watson is also a domain-independent, meaning it is not constrained to one specific field, but can be integrated to new fields but training it with specific knowledge and integrating it into the workflow. IBM hopes to make Watson more and more human, adding other important cognitive functions, and although it currently runs on the von Neuman structure, the creators are working on new technologies that combine neurons and on-chip synapses, as well as denser memory technologies.

I can only begin to imagine the applications of this technology. With increased cognitive computing abilities, our computers become more useable by the average user. It certainly begins to eliminate the differentiation between the advanced computer user and the novice. This will actually eliminate many jobs that we currently know, as the machines learn how to accomplish tasks that are inconvenient for humanity to accomplish. This could be extremely dangerous or extremely beneficial, depending on how you look at it. The issue appears when a computer’s conscious exceeds that of a human beings, if that were to ever happen. However, in the next few years, computers like Watson will become more and more suitable companions to human beings, perhaps even being used to train humans in proper behavior and etiquette. Someday, even the greatest world leaders will probably be trained by AI.

“At the age of six, he was able to exchange jokes with his father in classical Greek. The Neumann family sometimes entertained guests with demonstrations of Johnny's ability to memorise phone books. A guest would select a page and column of the phone book at random. Young Johnny read the column over a few times, then handed the book back to the guest. He could answer any question put to him (who has number such and such?) or recite names, addresses, and numbers in order…”

“…Von Neumann studied chemistry at the University of Berlin until 1923 when he went to Zurich. He achieved outstanding results in the mathematics examinations at the University of Budapest despite not attending any courses. Von Neumann received his diploma in chemical engineering from the Technische Hochschule in Zürich in 1926. While in Zurich he continued his interest in mathematics, despite studying chemistry, and interacted with Weyl and Pólya who were both at Zurich. He even took over one of Weyl's courses when he was absent from Zurich for a time. Pólya said [18]:- Johnny was the only student I was ever afraid of. If in the course of a lecture I stated an unsolved problem, the chances were he'd come to me as soon as the lecture was over, with the complete solution in a few scribbles on a slip of paper…”

“…When von Neumann realised he was incurably ill, his logic forced him to realise that he would cease to exist, and hence cease to have thoughts ... It was heartbreaking to watch the frustration of his mind, when all hope was gone, in its struggle with the fate which appeared to him unavoidable but unacceptable…

... his mind, the amulet on which he had always been able to rely, was becoming less dependable. Then came complete psychological breakdown; panic, screams of uncontrollable terror every night. His friend Edward Teller said, "I think that von Neumann suffered more when his mind would no longer function, than I have ever seen any human being suffer."

Von Neumann's sense of invulnerability, or simply the desire to live, was struggling with unalterable facts. He seemed to have a great fear of death until the last... No achievements and no amount of influence could save him now, as they always had in the past. Johnny von Neumann, who knew how to live so fully, did not know how to die. …”

<http://www-history.mcs.st-and.ac.uk/Biographies/Von_Neumann.html>